

APPENDIX N

**PLACE N2, N3 AND N4 BEHIND EXISTING STABILITY ANALYSIS WHICH
IS NOW N1 (COVER SHEET FOR N1 IS INCLUDED HEREIN)**

N1
EXCAVATION SLOPE STABILITY ANALYSIS
AND
FINAL REFUSE FILL SLOPES

N2
RESPONSE TO LA-CITY LEA COMMENTS
SUNSHINE CANYON LANDFILL CITY-COUNTY JTD
FEBRUARY 27, 2008



MEMORANDUM

TO: Paul Willman, BAS

DATE: February 27, 2008

FROM: ROBBIE WARNER, GLA

GLA JOB #: 2007.0009

RE: RESPONSE TO LA-CITY LEA COMMENTS
SUNSHINE CANYON LANDFILL CITY-COUNTY JTD

This memorandum presents GeoLogic Associates' (GLA) responses to comments on the Joint Technical Document (JTD) for the proposed Sunshine Canyon City/County Landfill by Wayne Tsuda of the City of Los Angeles LEA in a letter to Mark de Bie of the California Integrated Waste Management Board dated February 6, 2008. Only the first two paragraphs of Comment 3 from this letter are addressed in this memorandum.

* * * * *

COMMENT 3 – Previous City LEA Comment Number 37, JTD was not addressed,

Appendix M, Excavation Slope Stability Analysis and Final Refuse Fill Slopes, Figure 7-6, and Figure 7-7, and Figure 7-8, Section C-C' and Section D-D'; The Section C-C' and Section D-D' slope stability analyses cross section have a stabilizing toe berm which abuts next to "existing topography". The "existing topography" in the area of the previous closed/inactive City Landfill.

Figure 7-7 and Figure 7-8 should show the MSW portion in the cross section depiction. Please differentiate the portions that are soil, and the portions that are MSW. Please also confirm that in the assessment of the slope stability, the modeling took into consideration of the lower density of the MSW at the toe of the proposed landfill expansion."

The newest submission (November 2007, Appendix S) does not have the same slope stability analysis as the previous submission. The current submission's analysis is not applicable to the current proposed expansion. See Figure 13 and Figure 18, and compare to Figure 1a and Figure 1b included in Appendix S (Slope Stability Analysis SCL City) for which the slope stability analysis was performed. The stability analysis was not done on the proposed final contours, and this whole section is inadequate for our analysis and incorrect as written. The current Appendix S is not applicable to the expansion.

RESPONSE:

The comments for each cross section will be addressed individually below.

Cross Section C-C'

The extent of proposed waste is correctly shown in Cross Section C-C' (Figure 7-7). The buttress shown in this figure, which is currently in place, was constructed with compacted soil, however, not with roller-compacted concrete as shown in the figure. Since the potential stability failure surfaces presented in this figure run up the side slope liner at the toe, rather than through the stronger buttress, the stability analysis results presented in Figure 7-7 remain the critical analyses. As presented in Figures C-C1 to C-C3, the static factor of safety for a failure through the buttress at Cross Section C-C' is 1.81, and the pseudo-static yield acceleration is 0.30g; both of these parameters are less critical than the analyses presented in Figure 7-7. The stability analyses for potential failures through the buttress at Cross Section C-C' are presented herein three times: a static analysis with the material types clearly shown (Figure C-C1), a second identical analysis shown with the Figure 7-7 superimposed (Figure C-C2), and a pseudo-static analysis (Figure C-C3). Note that for all analyses presented with this memorandum, the material properties used, such as shear strength and unit weight, were identical to those used in the 2002 JTD analyses; as such, the density of 85pcf used for municipal solid waste (MSW) is consistent with current practice.

Cross Section D-D'

The commenter correctly stated that Cross Section D-D' (Figure 7-8) passes through a portion of the existing inactive City landfill. Based on a comparison of 1987 pre-development topography with the current topography, the extent of existing waste appears to be confined to a northwest-trending canyon which is separated from the access road by bedrock ridge, outcrops of which are currently visible on the surface. As presented in the attached stability analyses for Cross Section D-D', the bedrock ridge interrupts potential failure surfaces that would pass through the existing waste (see Figures D-D1 and D-D2). The static factor of safety for such a potential failure surface is 3.44, and the pseudo-static yield acceleration is greater than 0.67g; note that due to the high value of the actual yield acceleration, the stability analysis software was unable to converge on a solution for seismic coefficients greater than 0.67g (see Figure D-D3).

Recall that in Figure 7-8, the analysis passing through rock at the toe of Cross Section D-D' was the critical analysis, with a static factor of safety of 2.2 and a pseudo-static yield acceleration of 0.28g. Since the results of this analysis were not able to be recreated (and, indeed, the reanalysis proved to be much less critical), the potential liner failure mode was also reanalyzed for Cross Section D-D'. Attached Figures D-D3 to D-D6 present the results of the reanalysis of the liner failure mode; the static factor of safety is 1.97, and the pseudo-static yield acceleration is greater than 0.39g. As above, the stability analysis software was unable to converge on a solution for seismic coefficients

greater than 0.39g, so the actual yield acceleration is greater than this value (see Figure D-D6).

The maximum seismically-induced permanent displacement presented in the 2002 JTD for Cross Section D-D' of about 18 inches was based on a yield acceleration of 0.22g (see Table 7-6). Since the lowest yield acceleration for the reanalyses of Cross Section D-D' presented herein is greater than 0.39g, the estimate of 18 inches of seismically-induced permanent displacement from the 2002 JTD analyses is conservative.

* * * * *

I hope the above responses are satisfactory. If you have any questions or concerns, please do not hesitate to contact us at your convenience.



Robbie Warner
Senior Geotechnical Engineer



attach: Figures C-C1 to C-C3
Figures D-D1 to D-D6

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section C-C'
 Sunshine_GeoSyn_C-C'_0032.gsz
 Date: 2/27/2008
 Time: 6:34:24 PM
 Method: Spencer
 Slip Surface Option: FullySpecified
 Optimization: true
 Horz Seismic Load: 0

Material #: 1	Material #: 4
Description: Side Liner	Description: Waste Fill (not Bilinear)
Model: MohrCoulomb	Model: MohrCoulomb
Wt: 85	Wt: 85
Cohesion: 35	Cohesion: 0
Phi: 10	Phi: 33
Piezometric Line: 0	Piezometric Line: 0

Material #: 2	Material #: 6
Description: Base Liner	Description: Bedrock (Impenetrable)
Model: MohrCoulomb	
Wt: 85	
Cohesion: 665	
Phi: 15	
Piezometric Line: 0	

Material #: 3	
Description: Buttress Fill	
Model: MohrCoulomb	
Wt: 125	
Cohesion: 170	
Phi: 35	
Piezometric Line: 0	

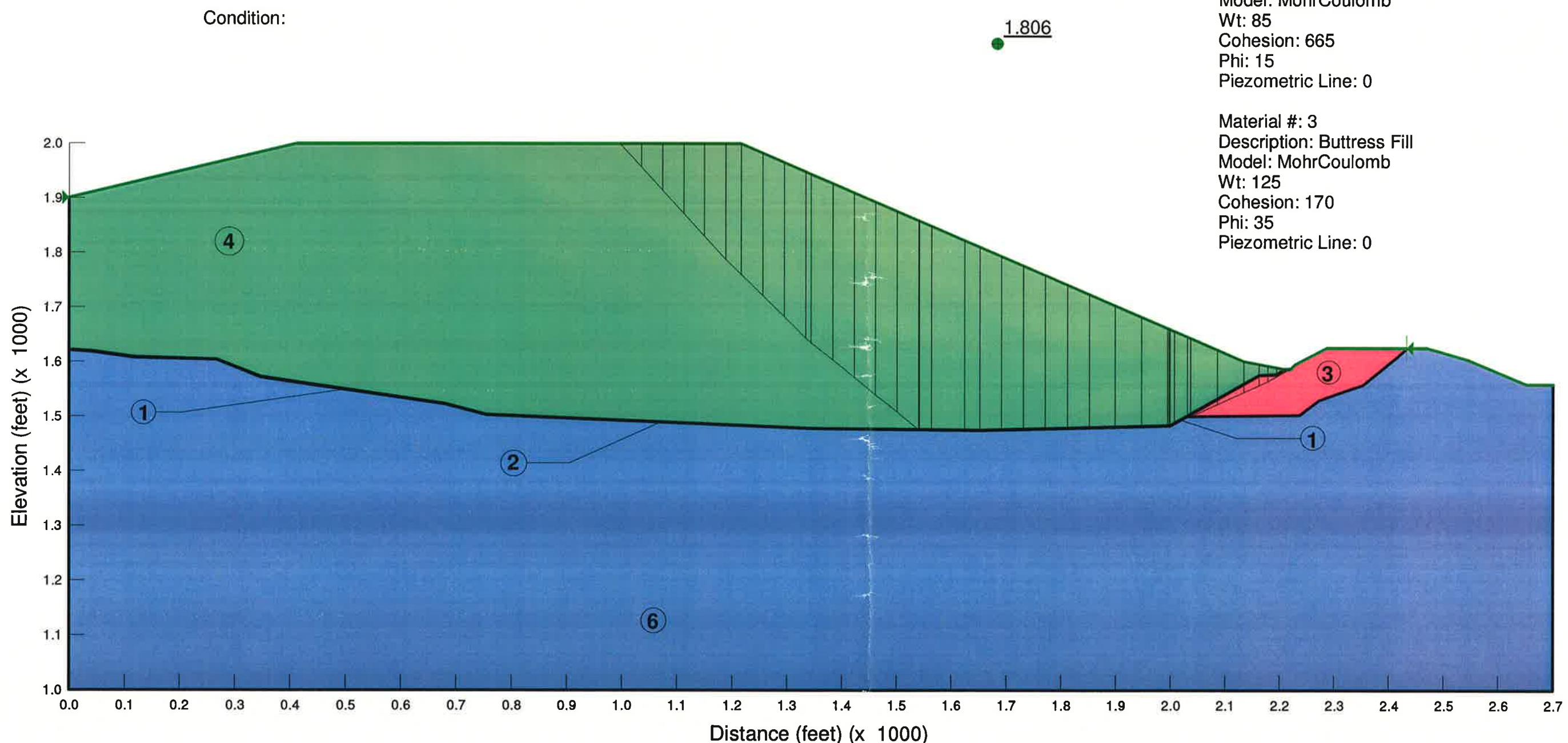


FIGURE C-C1

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section C-C'
 Sunshine_GeoSyn_C-C'_0032.gsz
 Date: 2/27/2008
 Time: 6:34:24 PM
 Method: Spencer
 Slip Surface Option: FullySpecified
 Optimization: true
 Horz Seismic Load: 0

Material #: 1 Description: Side Liner Model: MohrCoulomb Wt: 85 Cohesion: 35 Phi: 10 Piezometric Line: 0	Material #: 4 Description: Waste Fill (not Bilinear) Model: MohrCoulomb Wt: 85 Cohesion: 0 Phi: 33 Piezometric Line: 0
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Material #: 2 Description: Base Liner Model: MohrCoulomb Wt: 85 Cohesion: 65 Phi: 15 Piezometric Line: 0	Material #: 6 Description: Bedrock (Impenetrable)
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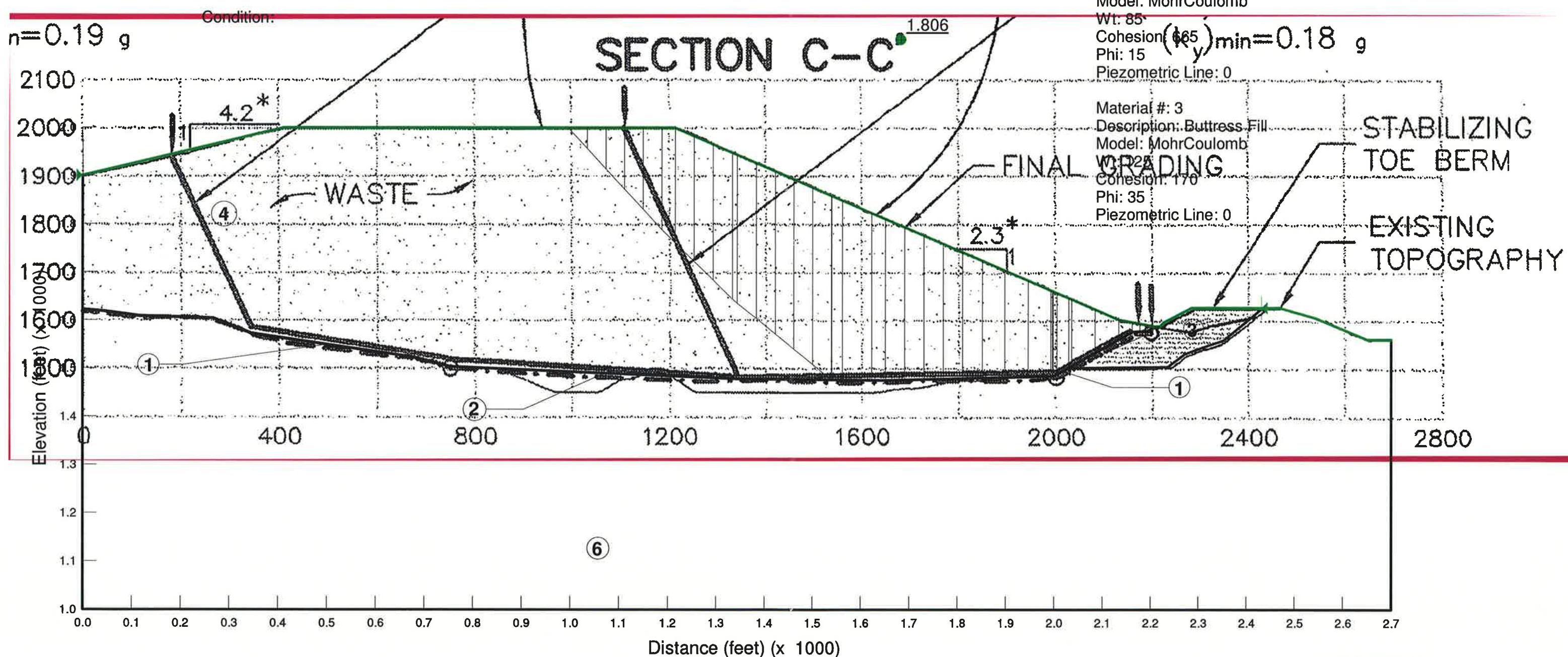


FIGURE C-C2

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section C-C'
 Sunshine_GeoSyn_C-C'_0032S02.gsz

Date: 2/27/2008
 Time: 6:43:58 PM
 Method: Spencer
 Slip Surface Option: FullySpecified
 Optimization: true
 Horz Seismic Load: 0.3

Material #: 1	Material #: 4
Description: Side Liner	Description: Waste Fill (not Bilinear)
Model: MohrCoulomb	Model: MohrCoulomb
Wt: 85	Wt: 85
Cohesion: 35	Cohesion: 0
Phi: 10	Phi: 33
Piezometric Line: 0	Piezometric Line: 0

Material #: 2	Material #: 6
Description: Base Liner	Description: Bedrock (Impenetrable)
Model: MohrCoulomb	
Wt: 85	
Cohesion: 665	
Phi: 15	
Piezometric Line: 0	

Material #: 3	
Description: Buttress Fill	
Model: MohrCoulomb	
Wt: 125	
Cohesion: 170	
Phi: 35	
Piezometric Line: 0	

Condition: Pseudo-Static; Proposed Waste Fill with Soil Buttress at Toe.

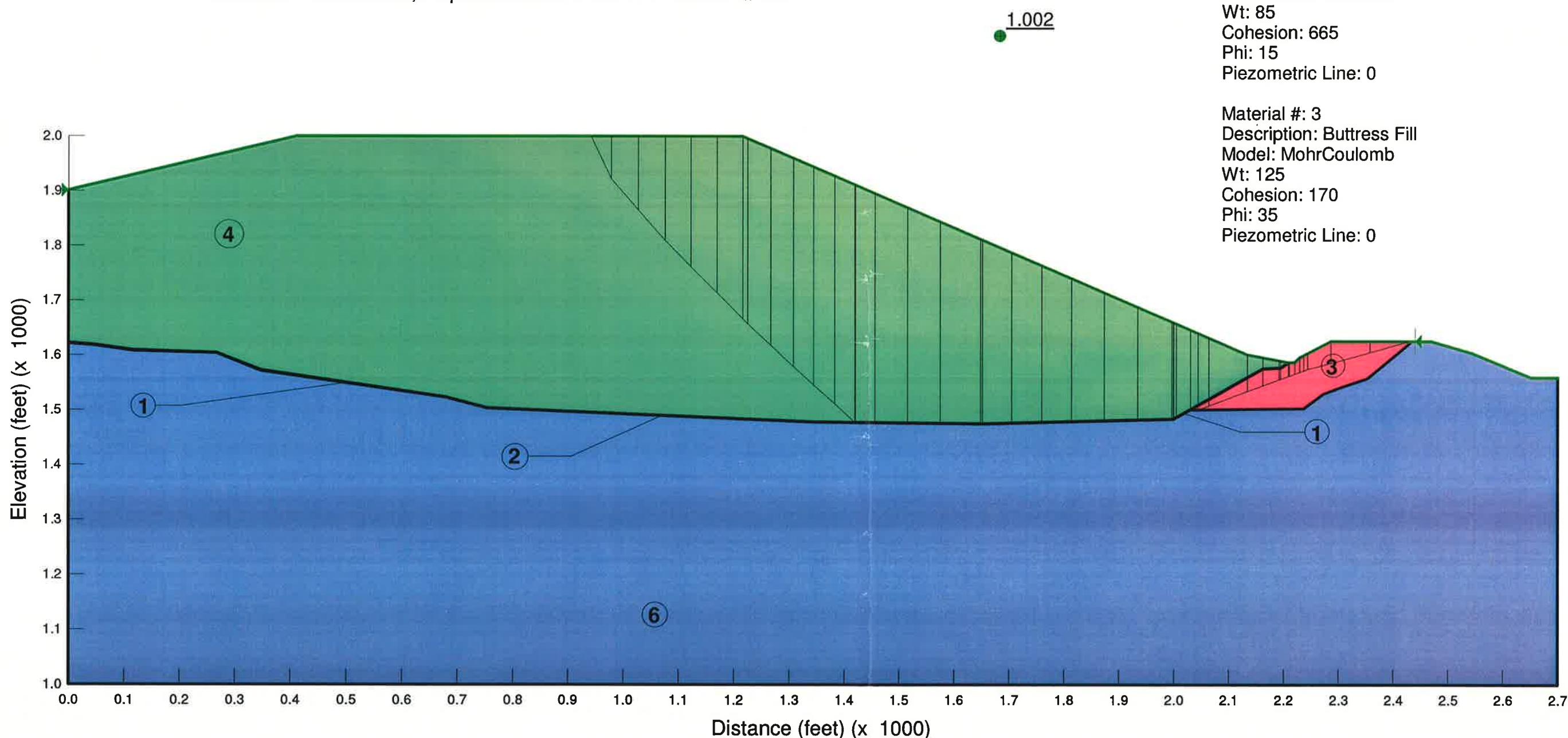


FIGURE C-C3

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section D-D'
 Sunshine_GeoSyn_D-D'_1054.gsz
 Date: 2/27/2008
 Time: 1:44:24 PM
 Method: Spencer
 Slip Surface Option: FullySpecified
 Optimization: false
 Horz Seismic Load: 0

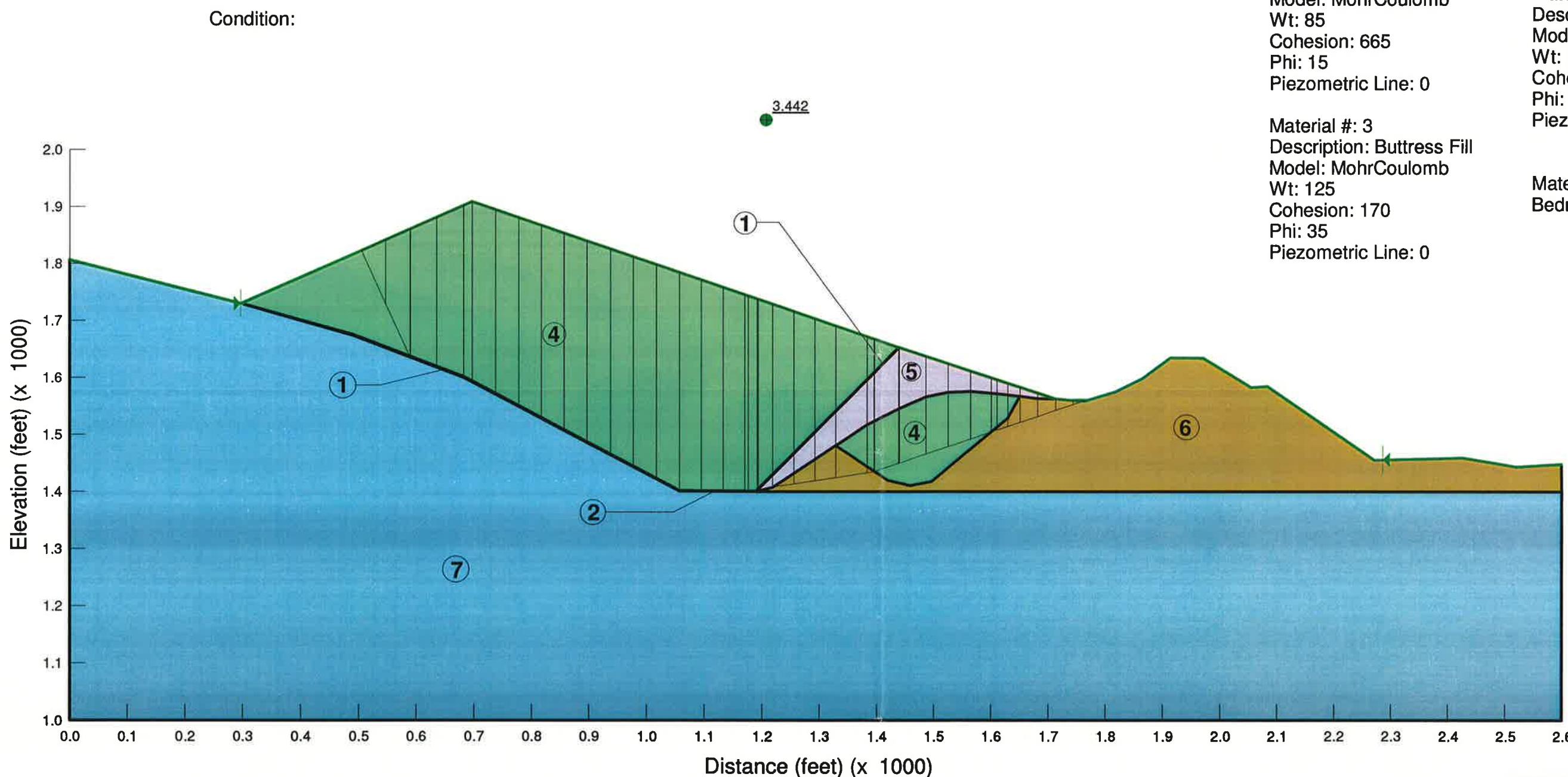


FIGURE D-D1

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section D-D'
 Sunshine_GeoSyn_D-D'_1054.gsz
 Date: 2/27/2008
 Time: 1:44:24 PM
 Method: Spencer
 Slip Surface Option: FullySpecified
 Optimization: false
 Horz Seismic Load: 0

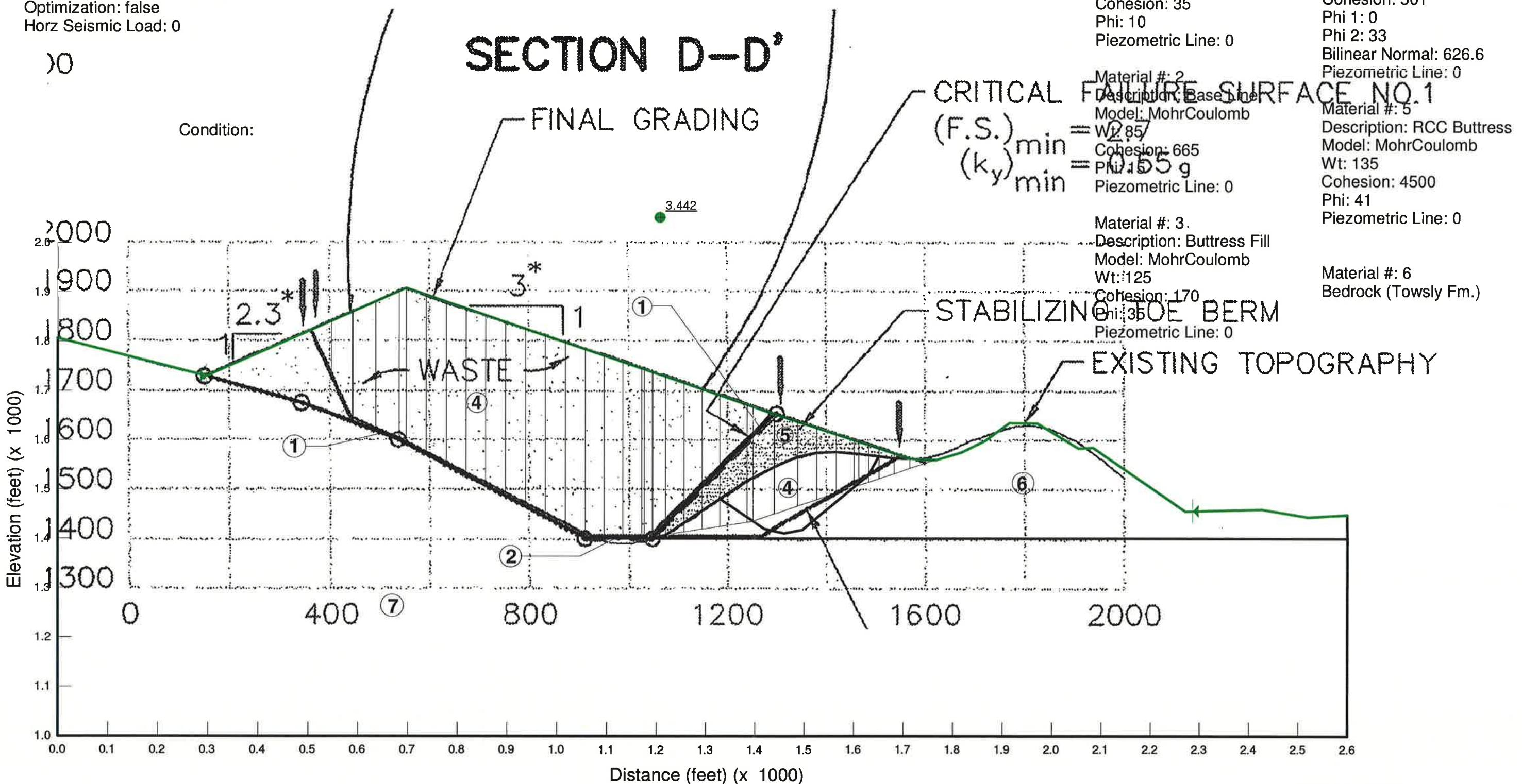


FIGURE D-D2

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section D-D'
 Sunshine_GeoSyn_D-D'_1054S07.gsz
 Date: 2/27/2008
 Time: 2:26:08 PM
 Method: Spencer
 Slip Surface Option: Fully-Specified
 Optimization: No
 Horz Seismic Load: 0.673

Material #1
 Name: Side Liner
 Model: Mohr-Coulomb
 Unit Weight: 85
 Cohesion: 35
 Phi: 10
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Material #4
 Name: Waste Fill
 Model: Bilinear
 Unit Weight: 85
 Cohesion: 501
 Phi 1: 0
 Phi 2: 33
 Bilinear Normal: 626.6
 Phi-B: 0
 Anisotropic Strength Fn: (none)

Material #2
 Name: Base Liner
 Model: Mohr-Coulomb
 Unit Weight: 85
 Cohesion: 665
 Phi: 15
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Material #5
 Name: RCC Buttress
 Model: Mohr-Coulomb
 Unit Weight: 135
 Cohesion: 4500
 Phi: 41
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Material #13
 Name: Buttress Fill
 Model: Mohr-Coulomb
 Unit Weight: 125
 Cohesion: 170
 Phi: 35
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Material #6
 Name: Bedrock (Towsly Fm.)
 Model: Mohr-Coulomb
 Unit Weight: 135
 Cohesion: 4500
 Phi: 41
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Condition: Pseudo-static Analysis; solution wouldn't converge for $K_y > 0.673$, so actual $K_y > 0.673$.

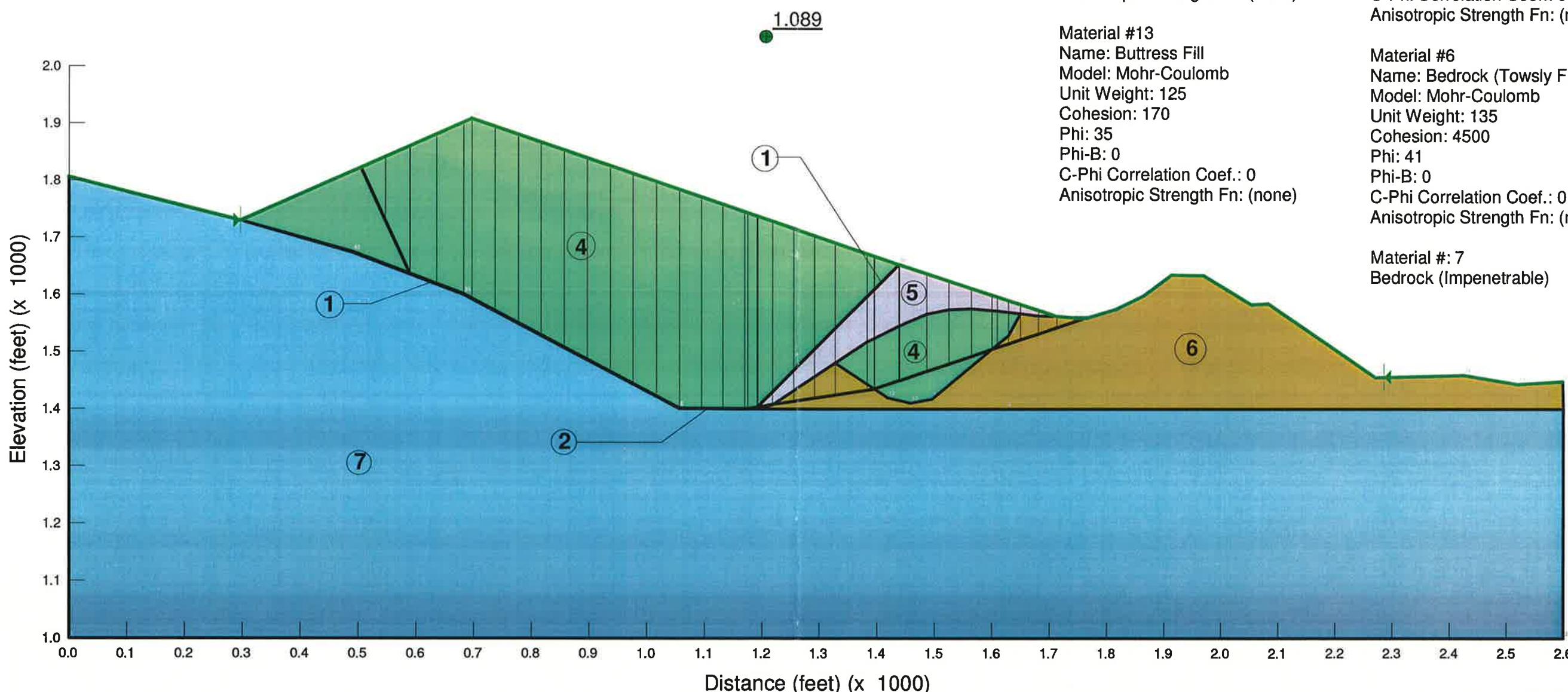
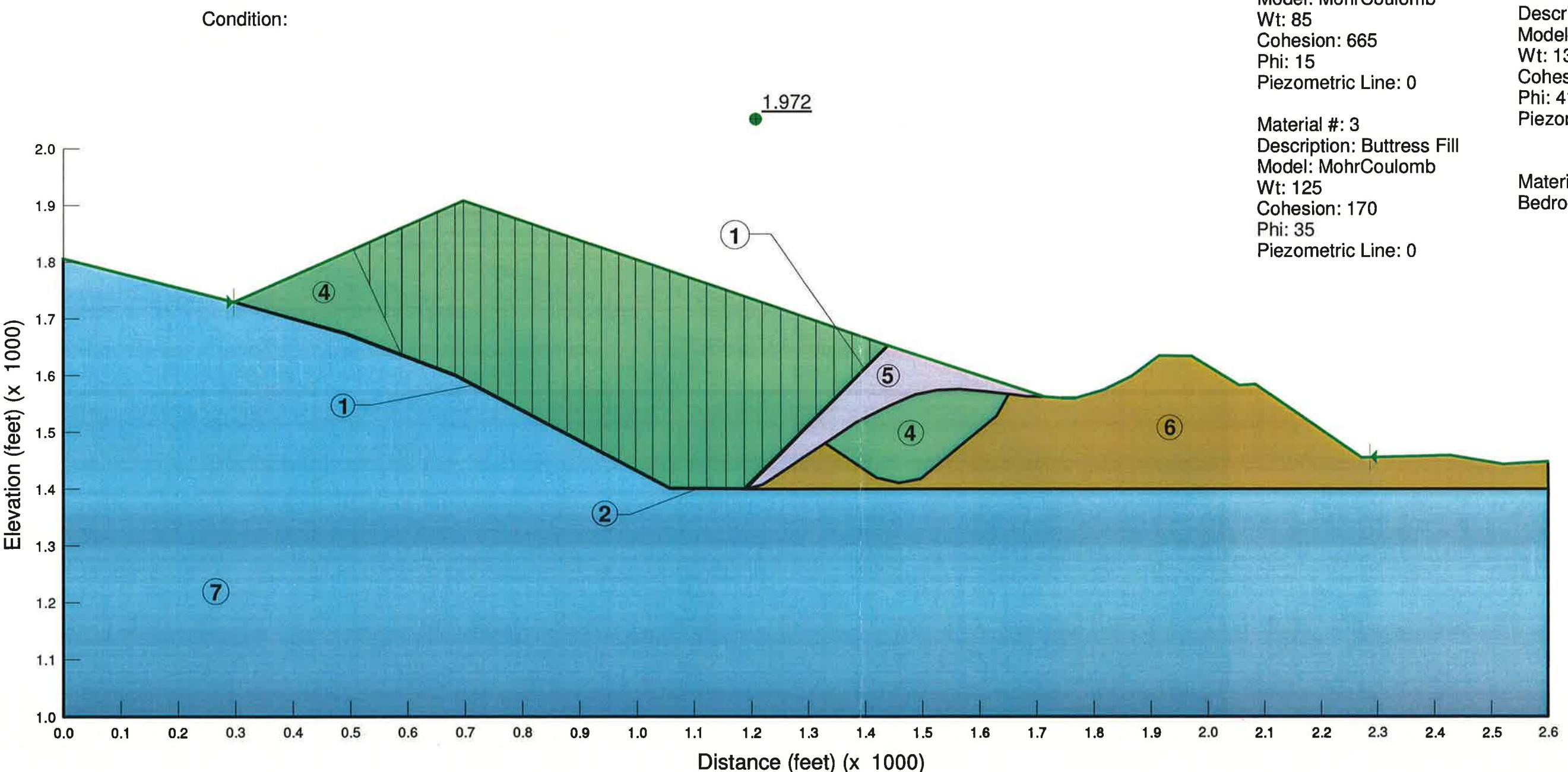


FIGURE D-D3

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section D-D'
 Sunshine_GeoSyn_D-D'_1041.gsz
 Date: 2/27/2008
 Time: 2:09:22 PM
 Method: Spencer
 Slip Surface Option: FullySpecified
 Optimization: false
 Horz Seismic Load: 0



Material #: 1	Material #: 4
Description: Side Liner	Description: Waste Fill
Model: MohrCoulomb	Model: Bilinear
Wt: 85	Wt: 85
Cohesion: 35	Cohesion: 501
Phi: 10	Phi 1: 0
Piezometric Line: 0	Phi 2: 33
	Bilinear Normal: 626.6
	Piezometric Line: 0
Material #: 2	Material #: 5
Description: Base Liner	Description: RCC Buttress
Model: MohrCoulomb	Model: MohrCoulomb
Wt: 85	Wt: 135
Cohesion: 665	Cohesion: 4500
Phi: 15	Phi: 41
Piezometric Line: 0	Piezometric Line: 0
Material #: 3	Material #: 6
Description: Buttress Fill	Bedrock (Towsly Fm.)
Model: MohrCoulomb	
Wt: 125	
Cohesion: 170	
Phi: 35	
Piezometric Line: 0	

FIGURE D-D4

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section D-D'
 Sunshine_GeoSyn_D-D'_1041.gsz
 Date: 2/27/2008
 Time: 2:09:22 PM
 Method: Spencer
 Slip Surface Option: FullySpecified
 Optimization: false
 Horz Seismic Load: 0

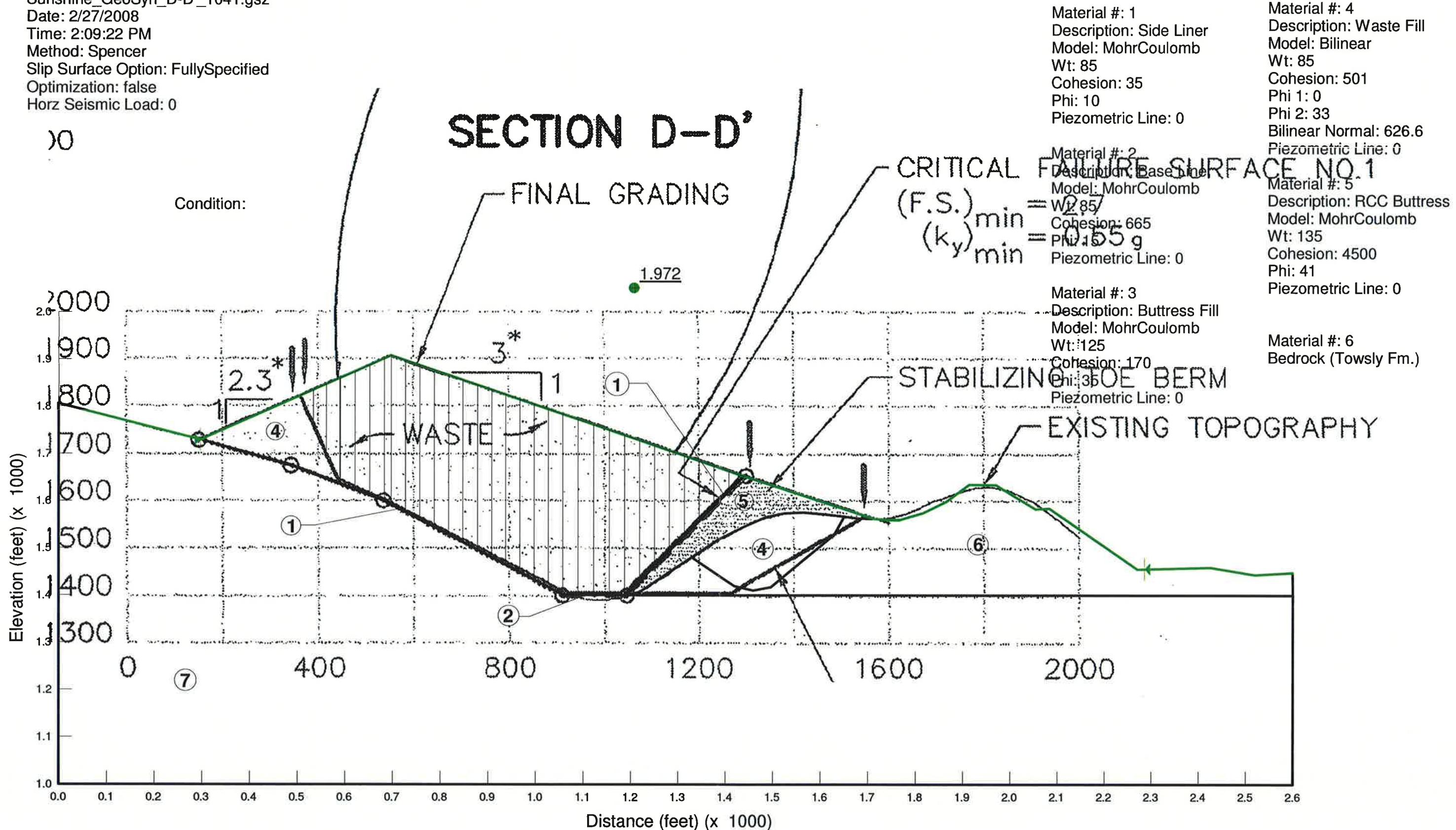


FIGURE D-D5

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section D-D'
 Sunshine_GeoSyn_D-D'_1041S01.gsz
 Date: 2/27/2008
 Time: 2:32:30 PM
 Method: Spencer
 Slip Surface Option: Fully-Specified
 Optimization: No
 Horz Seismic Load: 0.3872

Material #1
 Name: Side Liner
 Model: Mohr-Coulomb
 Unit Weight: 85
 Cohesion: 35
 Phi: 10
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Material #4
 Name: Waste Fill
 Model: Bilinear
 Unit Weight: 85
 Cohesion: 501
 Phi 1: 0
 Phi 2: 33
 Bilinear Normal: 626.6
 Phi-B: 0
 Anisotropic Strength Fn: (none)

Material #2
 Name: Base Liner
 Model: Mohr-Coulomb
 Unit Weight: 85
 Cohesion: 665
 Phi: 15
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Material #5
 Name: RCC Buttress
 Model: Mohr-Coulomb
 Unit Weight: 135
 Cohesion: 4500
 Phi: 41
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Material #3
 Name: Buttress Fill
 Model: Mohr-Coulomb
 Unit Weight: 125
 Cohesion: 170
 Phi: 35
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Material #6
 Name: Bedrock (Towsly Fm.)
 Model: Mohr-Coulomb
 Unit Weight: 135
 Cohesion: 4500
 Phi: 41
 Phi-B: 0
 C-Phi Correlation Coef.: 0
 Anisotropic Strength Fn: (none)

Material #7
 Bedrock (Impenetrable)

Condition: Pseudo-static Analysis

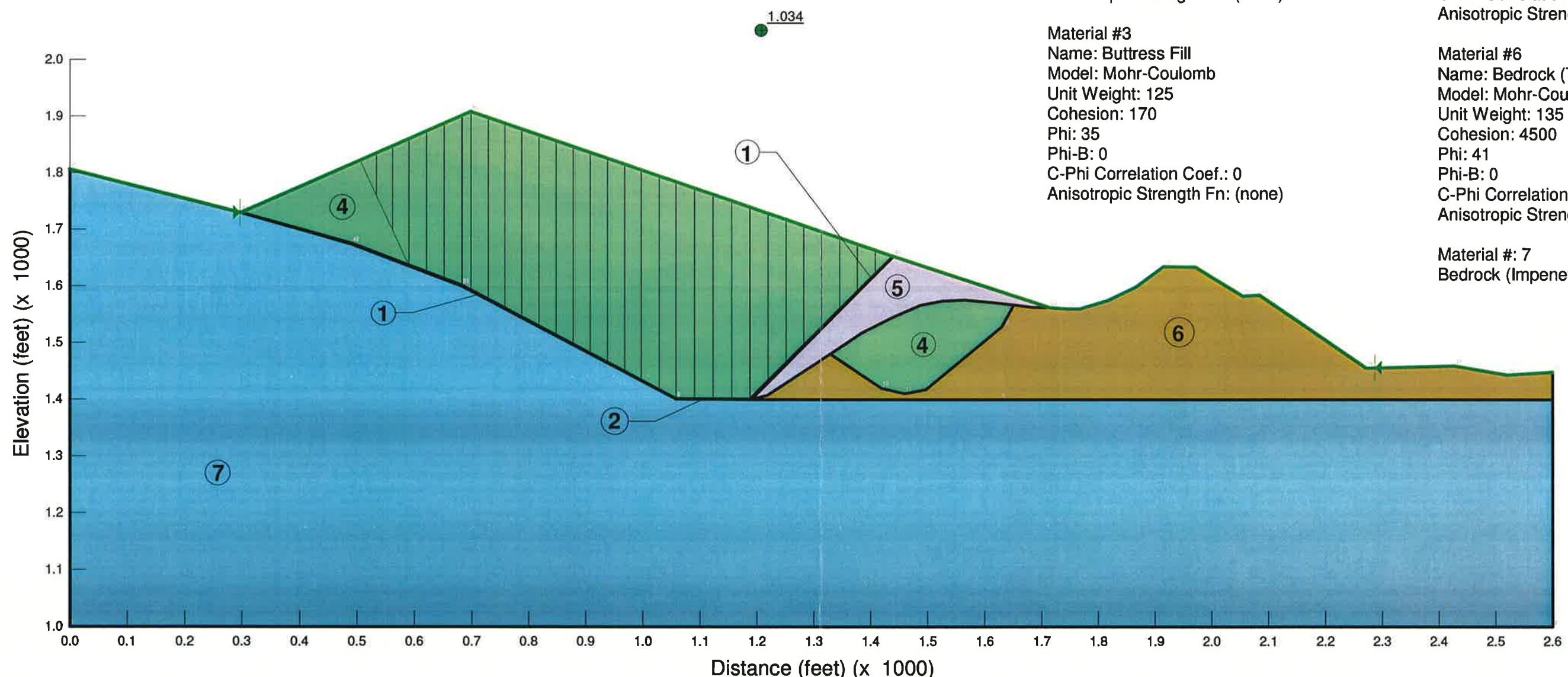


FIGURE D-D6

N3
RESPONSE TO LA-RWQCB COMMENTS
SUNSHINE CANYON LANDFILL CITY-COUNTY JTD
FEBRUARY 27, 2008
REVISION DATED MAY 14, 2008



MEMORANDUM

TO: PAUL WILLMAN, BAS

DATE: February 27, 2008
(Revision dated May, 14, 2008)

FROM: GARY LASS, GLA

GLA JOB #: 2007.0009

RE: **RESPONSE TO LA-RWQCB COMMENTS**
SUNSHINE CANYON LANDFILL CITY-COUNTY JTD

This memorandum presents GeoLogic Associates' (GLA) responses to comments on the Joint Technical Document (JTD) for the proposed Sunshine Canyon City/County Landfill by Rodney H. Nelson of the Los Angeles Regional Water Quality Control Board (RWQCB) in a letter to Mr. Dave Hauser of BFI/Sunshine Canyon Landfill dated February 7, 2008. Only Comments 2 and 4 from this letter are addressed in this memorandum.

In addition responding directly to the RWQCB comments, a series of additional sensitivity analyses were completed in order to respond to comments received from the City LEA in a meeting held on March 25, 2008 and summarized in an e-mail dated March 27, 2008 (attached). The slope stability component of these comments included:

1. *"Correct the cross section drawing for D-D' and E-E' to reflect that the proposed expansion actually is on top of an old existing landfill section*
2. *The toe of the landfill also intersects part of the closed City Landfill. Review if the potential settlement of the closed landfill may potentially impact the functionality of the toe berm.*
3. *Redo the stability analysis for Section D-D' and E-E' (or new critical planes) to account for the fact that the proposed expansion is on an existing closed City landfill, and that the base liner angle will be steeper due to additional settlement of the existing landfill ("bowling" effect). Also prepare an analysis to show the "sensitivity" of safety factor of this potential increase slope angle for the base liner that is placed over an existing landfill.*
4. *Redo the identification of the critical planes with the proposed design (if needed).*
5. *On Section D-D', the parameters/calculations indicate the use of cementitious materials being used for the toe berm. Since this is not what is ideal (e.g., cracking, etc.) and not what is actually being proposed, revise the drawings (and cross sections) to reflect what is actually being proposed, (e.g., soil, MSW, etc.) The slope stability analysis should be redone to reflect the changes."*

In its e-mail, the City of Los Angeles LEA also requested that GLA

*"Revise/complete the settlement contour drawing to show the "calculated settlement in feet for "City-Side" landfill refuse place[d] before 2010".
(Drawing only revised to show the County side but not the City side). Please note, that this should also include the areas of the currently closed City landfills)"*

Subsequent to receipt of the LEA's e-mail request, an additional verbal request was made to evaluate the effect of incorporating the existing final cover over the City-Side Landfill in the slope stability analyses and this evaluation is also included herein.

For simplicity of presentation, the following discussion of the new analyses is organized sequentially.

COMMENT 2 – STABILITY ANALYSES: *Appendix N of the JTD includes slope stability analyses that were prepared in 2002 for a previous JTD. However, landfill designs in the new JTD are different from those assumed in the 2002 JTD. Specifically, the new JTD proposes a double composite liner system and a final cover system that includes a low permeability (clay) layer, while the 2002 JTD assumed a single composite liner system and a final cover system that included geosynthetic clay liners instead of a clay layer. We understand that BFI will submit stability analysis design plans for each phase of landfill development. However, stabilities of the overall landfill configuration and final refuse slope must be demonstrated in the JTD. In accordance with section 21750(f)(5) of 27 CCR, stability analyses in the JTD must be updated.*

RESPONSE:

After additional discussions with the RWQCB, the California State Department of Water Resources (DWR) and the City of Los Angeles LEA, it was concluded that a revaluation of the strength characteristics assumed for the various liner materials and interfaces was appropriate and supplemental analyses of the slope stability of several critical sections has been completed.

Strength Characterization

The following shear strength characteristics were identified from "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces" (Koerner and Narejo, 2005) and from recent GCL testing completed by Geo-Logic Associates, Inc.

Peak Interface Shear Strength

	Clay - Unsat		Reinforced GCL		Textile	
	Phi	C	phi	c	Phi	C
Smooth HDPE	22	0			11	0
Textured HDPE	19	481	23	167	25	167
GCL Internal						
Sat			<i>16</i>	<i>794</i>		
Dry			<i>35</i>	<i>2061</i>		
Encapsulated			25	1428		
(Average)						

Large Displacement Interface Shear Strength

	Clay - Unsat		Reinforced GCL		Textile	
	Large Disp		Large Disp		Large Disp	
	Phi	C	phi	C	Phi	C
Smooth HDPE	18	0			9	0
Textured HDPE	22	0	13	0	17	0
GCL Internal						
Sat			<i>6</i>	<i>251</i>		
Dry			<i>31</i>	<i>1583</i>		
Encapsulated			19	917		
(Average)						

As a result of the above re-evaluation, GLA recommends that the supplemental analysis of the Sunshine Canyon design incorporate the following minimum strength parameters.

Material/Interface	Unit Wt (pcf)	Angle of Internal Friction (Phi)	Cohesion (C – lbs)
Bedrock	130	36	1000
Waste	85	Bilinear (Kavazanjian et al., 1995)	
Floor Liner	85	17	0
Slope Liner	85	13	0
Compacted Fill	125	35	170

Static Waste Slope Stability

Slope stability of the BAS (2007) liner and refuse fill grades was evaluated using the computer software SLOPE/W version 6.22 (2007) from GeoSlope to complete analyses in accordance with the Morgenstern-Price analytical method. [It should be noted that the latest version of SLOPE/W incorporates an “optimization” routine which refines the results derived from typical circular or block failure geometries by locally modifying the more regular failure geometries to identify even more critical configurations. As a result, the newest version of SLOPE/W generally yields moderately to significantly reduced factors of safety relative to conventional limit equilibrium analyses.] Liner and refuse fill slope geometries were established from cross sections at critical areas of the landfill,

including locations from previous analyses by GeoSyntec (Figure 1). Soil, refuse and liner interface shear strengths were derived from previous JTD analyses performed by GeoSyntec Consultants (2002) after incorporating the revisions noted above.

Waste Stability

In order to analyze the potential for failure through the deeper (and older) City-Side landfill, the first analyses incorporated the full depth of the old and new waste prism. As shown on Figures 2-C through 2-F, these analyses clearly indicate that the waste prism itself does not represent a critical material in the stability of the proposed design.

Waste-over-Waste Liner Stability

GLA's reevaluation of material strength characteristics resulted in a recommendation to revise some liner material properties. These somewhat reduced strengths in combination with the more rigorous analytical approach of SLOPE/W (v. 6.22) resulted in factors of safety below 1.5 for the current design along Section E-E' and F-F' (Figures 3-C through 3-F).

Since the low factors of safety along these sections are significantly affected by the relatively low shear strength associated with the smooth HDPE liner interface, it is recommended that the waste-over-waste liner design be modified to incorporate a double-sided textured configuration. While the beneficial effects of this minor design change is reflected in the results presented on Figures 4-C through 4-F, this change, by itself, still does not yield an adequate factor of safety and additional recommended design modifications are presented below.

Consolidation of Old City Waste

In attempting to address the potential for consolidation of the Old City-Side landfill to result in "sagging" of the waste-over-waste liner (and therefore creating a more critical liner geometry), it is first necessary to evaluate the depth of waste in the Old City-Side landfill. Since little documentation is available regarding the actual geometry of the bottom of the Old City waste cell, GLA estimated the minimum thickness of the Old City-Side landfill by comparing the original ground geometry (i.e., the 1952 USGS pre-landfill topography) to the existing surface geometry. Because there is significant uncertainty in this depth estimation, GLA evaluated the effects of "worst case" settlement by assigning liner strengths for the full thickness of the Old City-Side waste prism. In this way, Slope/W searched for the most critical geometry that could possibly be generated by settlement of the waste-over-waste liner system. As shown on Figures 5-C through 5-F, potential settlement of the waste-over-waste double-sided textured liner system could result in worst-case reductions in static factors of safety of about 5 to 10%.

Because both the proposed and consolidated waste-over-waste liner yield static factors of safety significantly less than 1.5, incorporation of additional design modifications will be necessary to yield a stable condition.

Integrity of Toe Berm Fill

In some areas (i.e., Section F-F'), a portion of the proposed toe berm will be constructed over pre-existing Old City-Side waste and it is, therefore, possible that settlement of the older waste prism could result in some deformation and partial loss of shear strength in the berm fill. In order to assess the potential effects of this condition, the shear strength of the fill was reduced by 25% in areas where it overlies waste. As shown on Figures 6-Fa and 6-Fb, this reduction in the toe berm fill shear strength does not have a significant affect on the calculated stability of the waste prism.

Remedial Recommendations

In reviewing potential design modifications that could be implemented in order to improve stability conditions, the consolidated Old City-Side waste configuration using deformed toe berm fill strengths (where appropriate) was selected as the base or "worst case" configuration.

As noted above, the first recommended modification to the existing design includes the installation of double-sided textured HDPE in place of single-sided HDPE in critical slope areas of the waste-over-waste liner system. This design change is already incorporated in the calculations summarized above and as shown, it does not, by itself, yield an adequate factor of safety for all sections.

The unacceptable factors of safety for the consolidated Old City-Side waste configuration along Sections E-E' and F-F' are largely the result of the relatively shallow outside liner slope that is incorporated in the current design. Since this geometry creates a low strength critical exit geometry, it is recommended that the inside face of the toe berm be steepened and moved inboard prior to placement of a liner in order to force any potential failure to break out through the waste prism. Since incorporation of a steep, lined, inside berm face produces an adequate factor of safety for failure over the toe berm, the potential for a different critical failure to propagate through the toe berm was also evaluated. In order to effectively mitigate both potential critical surfaces, it is necessary to steepen the inside face of the toe berm, to widen the access road and to steepen the outside face of the toe berm. The results of these recommended two design changes are reflected in Figures 7-E and 7-F.

Liner Over Alternative Final Cover

The final sensitivity analyses considered the potential effect of including the existing City-Side Landfill final cover on the calculated stability of the design. The alternative final cover was modeled as six feet thick with an internal shear strength equal to the degraded buttress fill discussed above. Figure 8-E presents the result of this analysis and in combination with Figure 7E clearly indicates that the existing final cover has a minimal impact on the calculated factor of safety.

Seismic Waste Displacement Calculations

As a result of the above analyses, it is concluded that Figures 3C, 5D, 7E, and 7F represent the critical static stability conditions for the fully mitigated design. Dynamic displacement analyses were completed for these sections using the methods of Bray and Rathje (1998). Figures 9-C through 9-F present the calculated yield accelerations for each of the four critical sections and the seismic displacements calculated for the site design earthquake are shown Tables 1 through 4.

Final Cover Stability

In the proposed 2007 cover design, the geosynthetic clay liner of the 2002 cover design has been replaced by a 1-foot-thick low-permeability soil layer. Potentially critical interfaces in the proposed design are the geocomposite drainage layer – textured geomembrane interface and the textured geomembrane – low-permeability soil interface. Allowing that the geocomposite – geomembrane interface shear strengths are lower than those of the critical interface in the 2002 design, a high-strength geogrid placed within the vegetation soil layer has been added to the proposed 2007 slope cover section design to increase the tensile capacity of the geosynthetic layers above the low-permeability soil layer. The minimum allowable tensile strength¹ for this geogrid shall be 4,390 lbs/ft. The anchor trench details will be modified, if necessary, to ensure that the required tensile demand can be mobilized. With this revised design, the cover stability static factor of safety is 1.55, and the potential seismically-induced permanent deformation of the cover section is estimated at a maximum of 2 inches (see attached calculation). The proposed revised 2007 cover design is, therefore, acceptable.

Slope Stability Conclusion

Based on the analyses presented herein, it is concluded incorporation of the mitigation measures presented herein will yield a design that satisfies the slope stability requirements of the California Code of Regulations Title 27.

COMMENT 4: - SETTLEMENT ANALYSIS: *Section E.1.4 and Appendix K of the JTD present a settlement analysis for the Landfill after final closure. However, Figure 1 of Appendix K does not show any settlement in the Phase I and II areas of the current County Extension Landfill. We are unclear if this is due to the fact that the iso-settlement contour interval is too great (20 feet) so that smaller settlements could not be displayed, or those areas were not included in the analysis. In either case, the JTD should clarify whether settlement will occur in those areas. Because of the relatively flat final grade in the northern portion of the Landfill, any settlement may affect the surface water drainage system in that area...*

¹ $T_A = LDTS = T_{uh}/(RF_{CR} \times RF_{ID} \times RF_D)$

RESPONSE:

Since much of the waste in the Sunshine County Extension Landfill Phases I and II will have been in place for 20 to 30 years when the new City/County waste is placed, the contribution to remaining settlement after closure in year 2037 from the currently permitted County is expected to be minimal. Regardless, Figure 1 from Appendix K has been revised to include remaining settlement in this area. At the request of the City of Los Angeles LEA, the individual data points used to construct settlement contours in other areas of the site are also presented (see attached revised Figure 1).

Since the southeastern half of the waste-over-waste landfill will be constructed within the next five to ten years (as Phase III of the proposed expansion), the load applied by this waste will have been in place for over 20-years prior to the proposed closure date. This pre-closure loading should pre-consolidate the Old City-Side waste prism and yield a post-closure settlement potential for these materials of no more than 2-5% of their total depth. The northwestern portion of the proposed expansion will load the Old City-Side landfill nearer to the closure date and the maximum residual settlement is estimated to be less than 10% of the total waste depth.

As was noted in the discussion of the waste-over-waste landfill stability presented above, little data exists regarding the actual configuration of the bottom of the Old City-Side landfill. As a result and, similar to the approach used in the stability analyses, potential settlement was estimated by applying the estimated remaining settlement potential at closure (i.e., 2-10%) to the "minimum" waste depth calculated on the basis of the original (USGS) ground configuration. While this analysis is believed to be very conservative, Figure 1 represents the worst-case settlement calculated in this way.

CLOSURE

This memorandum is based on the project as described and the geotechnical data obtained from cited sources. Our firm should be notified of any pertinent change in the project plans or if conditions are found that differ from those described herein, since this may require a revaluation of our conclusions. This memorandum has not been prepared for use by parties or projects other than those named or described above. It may not contain sufficient information for other parties or other purposes.

This memorandum has been prepared in accordance with generally accepted geotechnical practices and makes no other warranties, either express or implied, as to the professional advise or data included in it.

GeoLogic Associates



Robbie Warner
Senior Geotechnical Engineer



Revised Figure 1

Attachments:

Attachment #1 – Static Waste Stability Calculations

Figures 2C through 8-E

Attachment #2 – Seismic Waste Displacement Calculations

Figures 9-C through 9-F

Tables 1 through 4

Attachment #3 – Cover Stability and Seismic Deformation Calculation

Attachment #4 – LEA e-mail of 3-27-08

EXPLANATION:

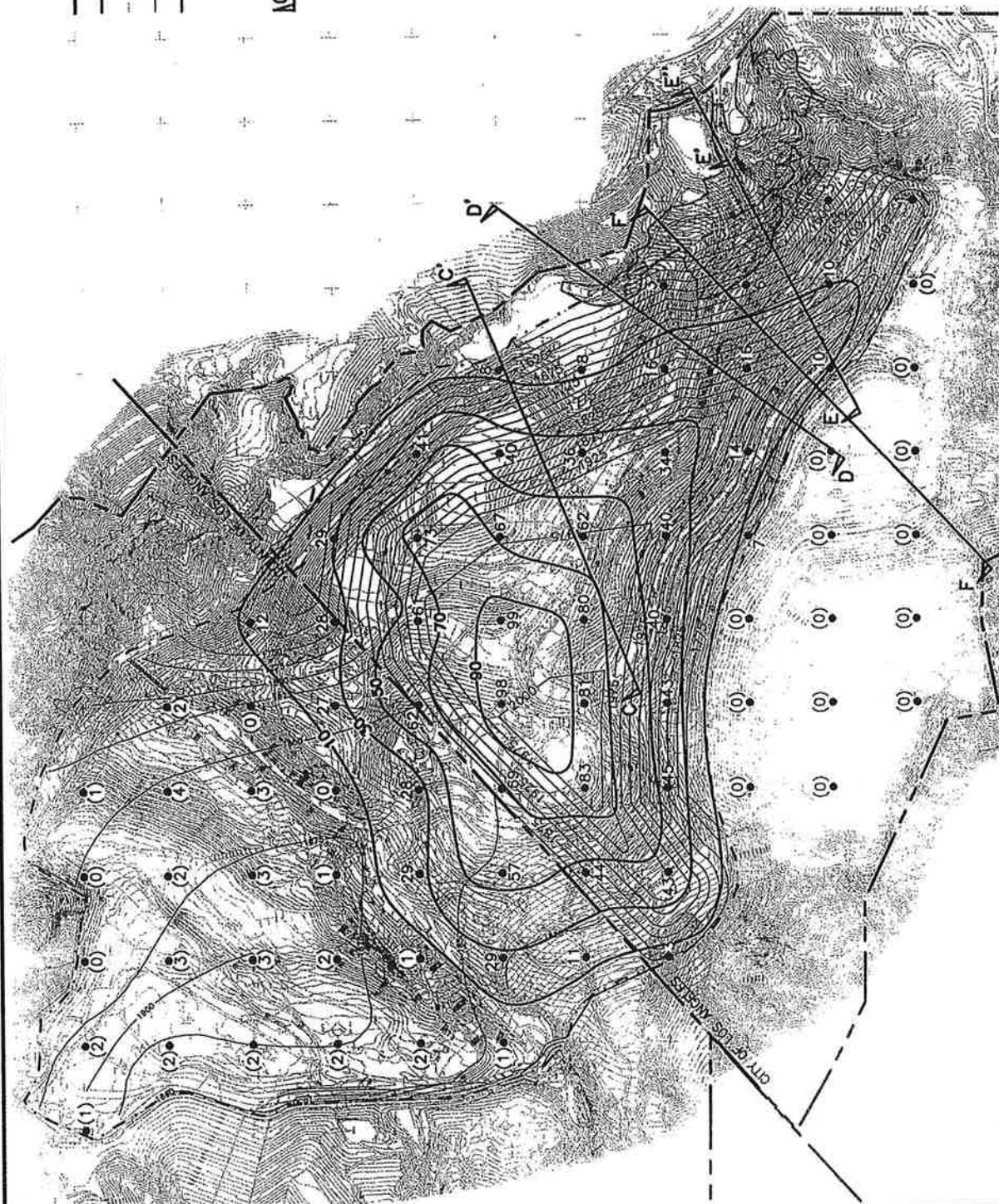
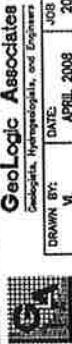
- — — APPROXIMATE PROPERTY BOUNDARY
- - - APPROXIMATE LIMIT OF REFUSE
- - - - EXISTING GRADE CONTOUR
- - - FINISHED GRADE CONTOUR
- 50 LINE OF EQUAL REFUSE SETTLEMENT IN FEET FOR REFUSE PLACED BEFORE 2010
- (1) CALCULATED SETTLEMENT IN FEET AT TIME OF CLOSURE
- 61 CALCULATED REFUSE SETTLEMENT IN FEET AT TIME OF CLOSURE
- C C' SLOPE STABILITY CROSS-SECTION LOCATION

AERIAL TOPOGRAPHY DATED 5-24-07

GRAPHIC SCALE
300 0 150 300 600
(in feet)
1 Inch = 600 ft.

FIGURE 1

ANTICIPATED REFUSE SETTLEMENT AT TIME OF CLOSURE
JOINT TECHNICAL DOCUMENT
SUNSHINE CANYON LANDFILL
LOS ANGELES, CALIFORNIA



ATTACHMENT 1

STATIC WASTE STABILITY CALCULATIONS

WASTE STABILITY

Sunshine Canyon Landfill
 BAS 2007 Design - Section C-C
 Sunshine_BAS_C-C_0001.gsz
 Date: 4/17/2008
 Time: 10:51:58 AM
 Method: Morgenstern-Price
 Slip Surface Option: AutoSearch
 Optimization: true
 Horz Seismic Load: 0

Condition: Failure through waste prism using bilinear strengths from GeoSyntec (1995)

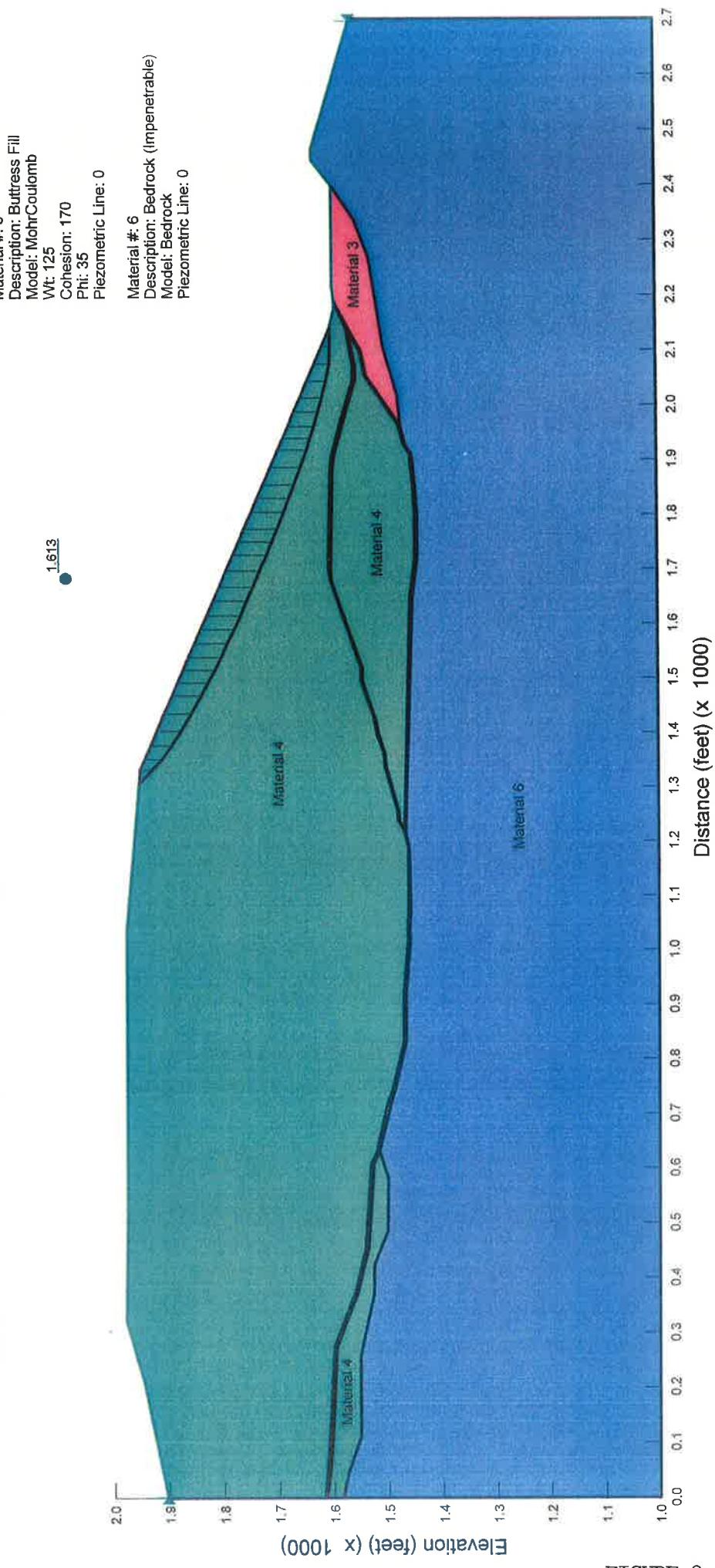


FIGURE 2-C

Sunshine Canyon Landfill
 BAS 2007 Design - Section D-D'
 Sunshine_BAS_D-D'_0001_9 deg.gsz
 Date: 4/18/2008
 Time: 11:19:47 AM
 Method: Morgenstern-Price
 Slip Surface Option: AutoSearch
 Optimization: true
 Horz Seismic Load: 0

Condition: Failure through waste prism using bilinear strengths from GeoSyntec (1995)

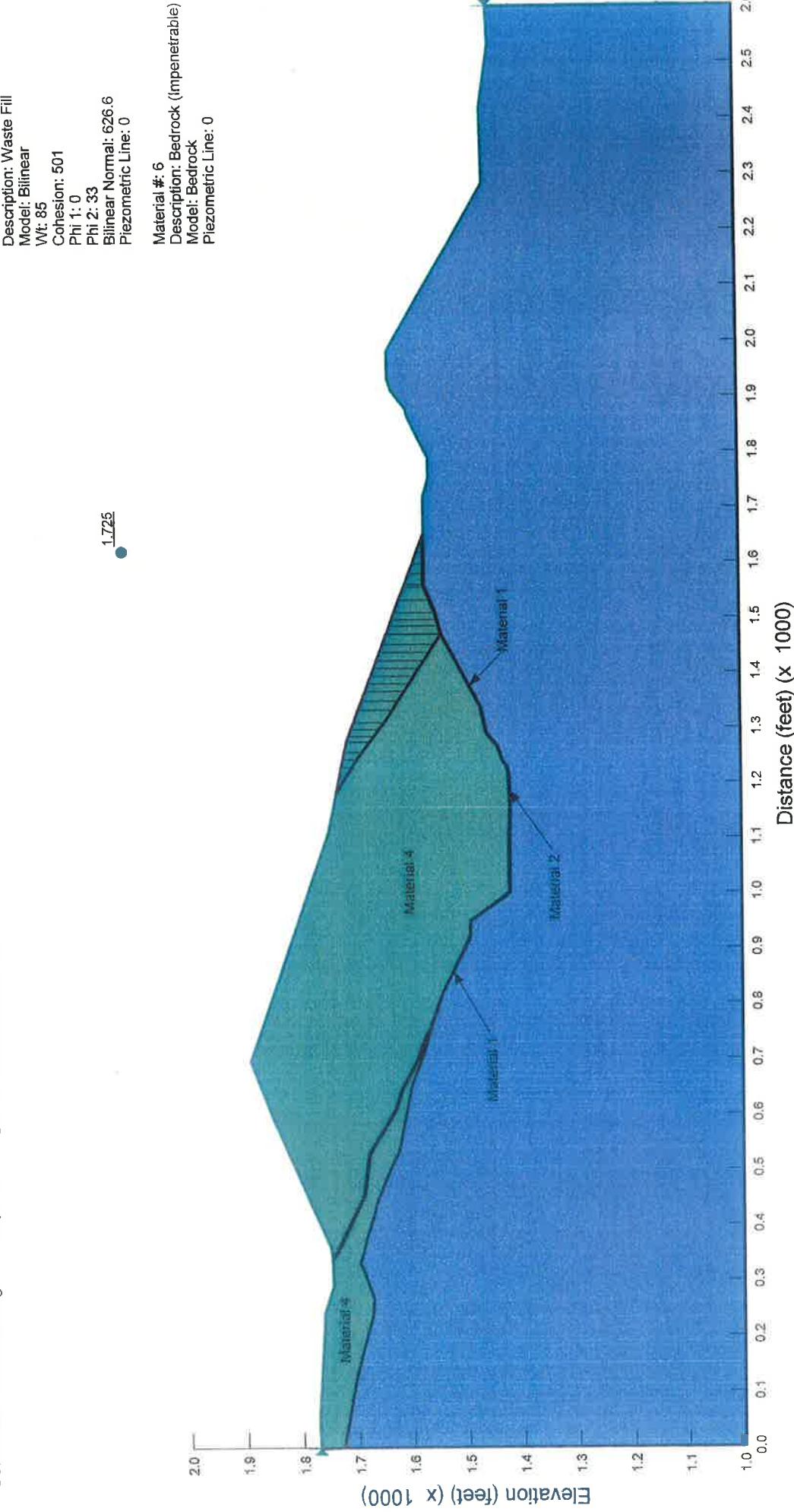


FIGURE 2-D

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section E-E''
 Sunshine BAS_E-E'_0001.gsz
 Date: 4/3/2008
 Time: 2:43:06 PM
 Method: Morgenstern-Price
 Slip Surface Option: AutoSearch
 Optimization: true
 Horz Seismic Load: 0

Condition: BAS Original Toe Buttress Design. Failure within refuse prism.

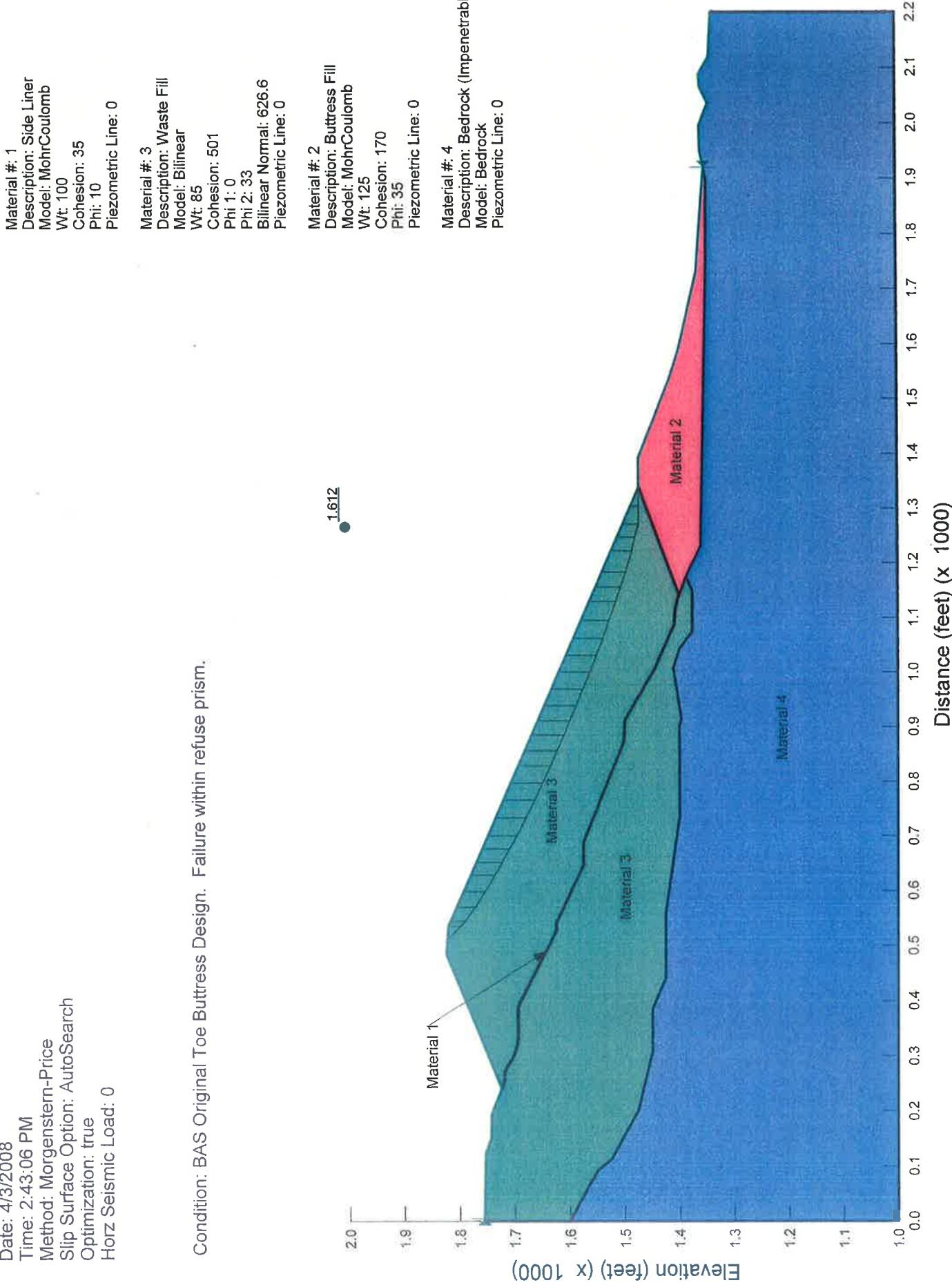


FIGURE 2-E

Sunshine Canyon Landfill
 Landslide Investigation; BAS Grades Section F-F'
 Sunshine BAS_001_refuse failure.gsz
 Date: 4/17/2008
 Time: 9:58:44 AM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0

Condition: BAS Original Design Failure through refuse

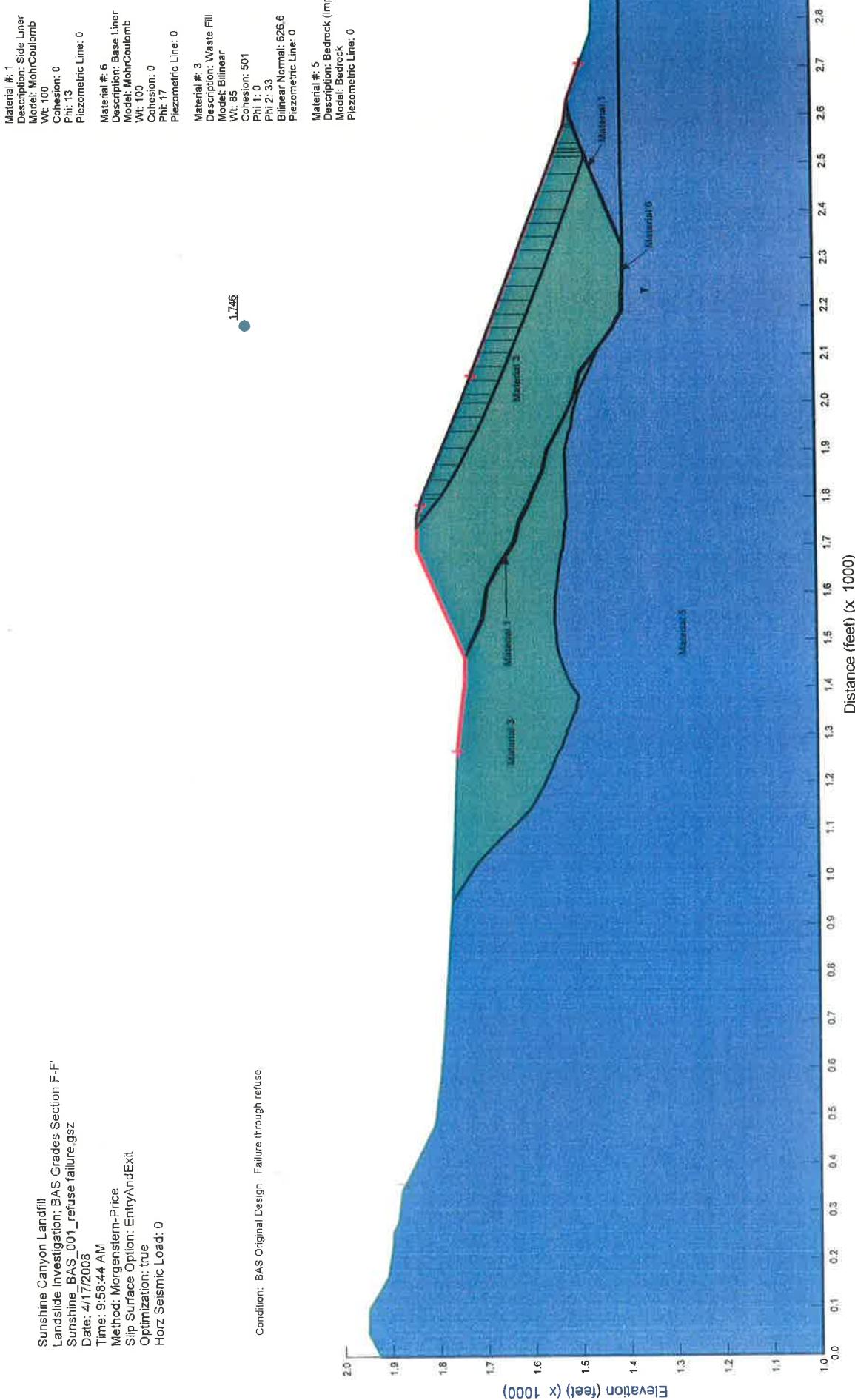


FIGURE 2-F

**WASTE-OVER-WASTE LINER STABILITY
NO "SAG"
SINGLE-SIDED TEXTURED HDPE**

Sunshine Canyon Landfill
 BAS 2007 Design - Section C-C'
 Sunshine_BAS_C-C'_0004_9 deg.gsz
 Date: 4/18/2008
 Time: 11:09:37 AM
 Method: Morgenstern-Price
 Slip Surface Option: GridAndRadius
 Optimization: true
 Horz Seismic Load: 0

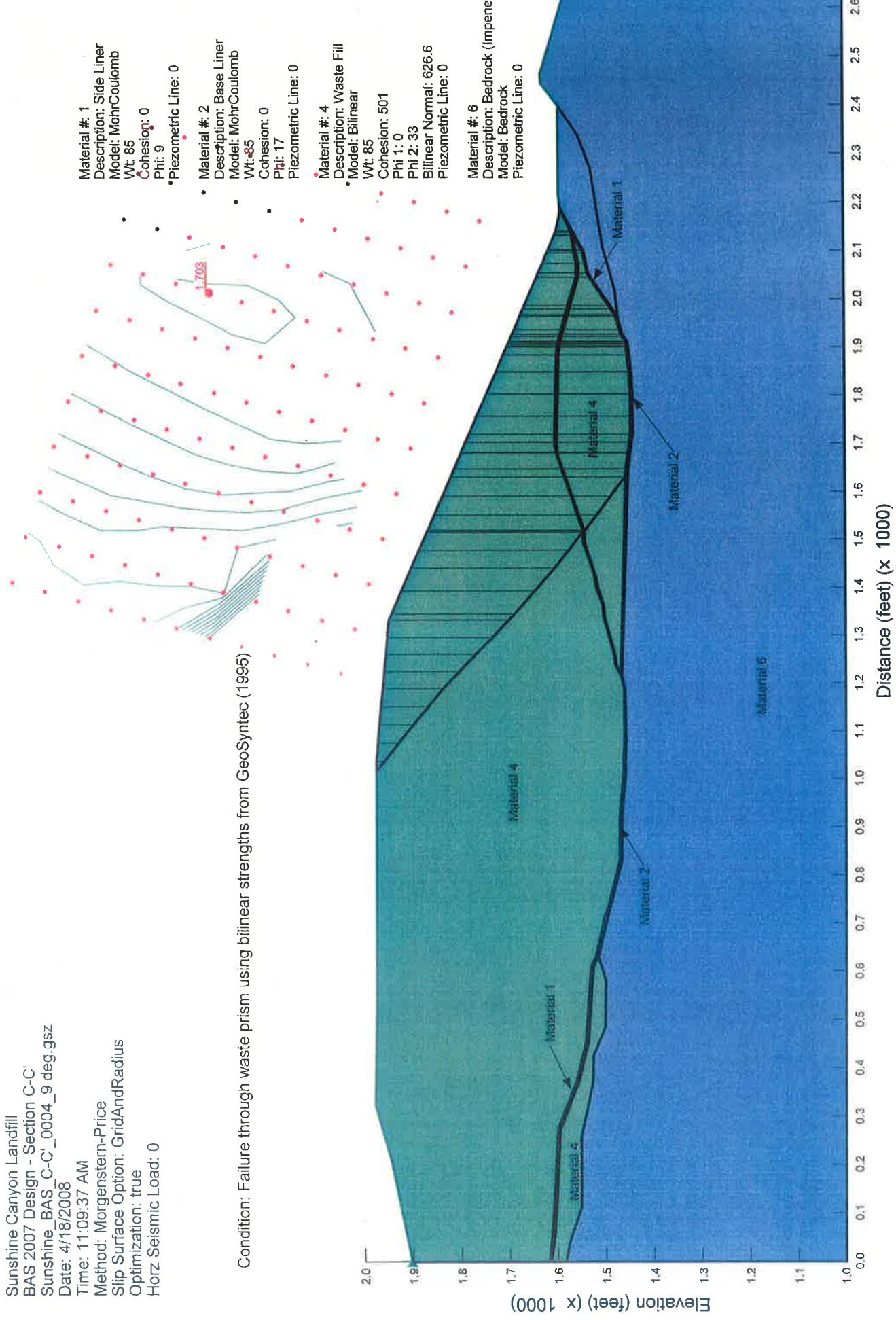


FIGURE 3-C

Sunshine Canyon Landfill
 BAS 2007 Design - Section D-D'
 Sunshine_BAS_D-D'_00003_9 deg.gsz
 Date: 4/18/2008
 Time: 11:28:04 AM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0

Condition: Failure through waste prism using bilinear strengths from GeoSyntec (1995)

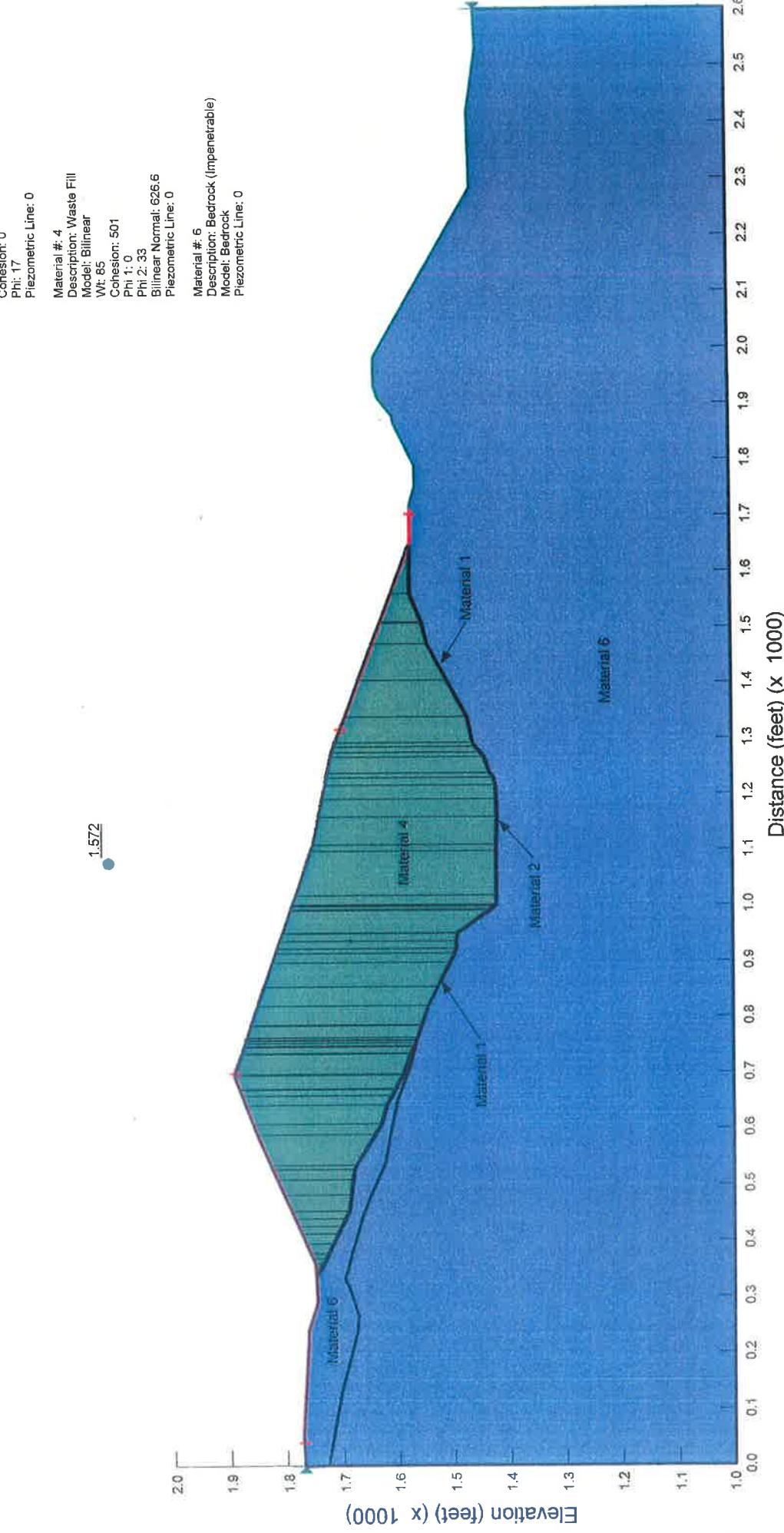


FIGURE 3-D

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section E-E"
 Sunshine_GeoSyn_E-E'_0002_Orig Design_9 deg.gsz
 Date: 5/14/2008
 Time: 11:21:57 AM
 Method: Morgenstern-Price
 Slip Surface Option: AutoSearch
 Optimization: true
 Horz Seismic Load: 0

Condition: Original design.

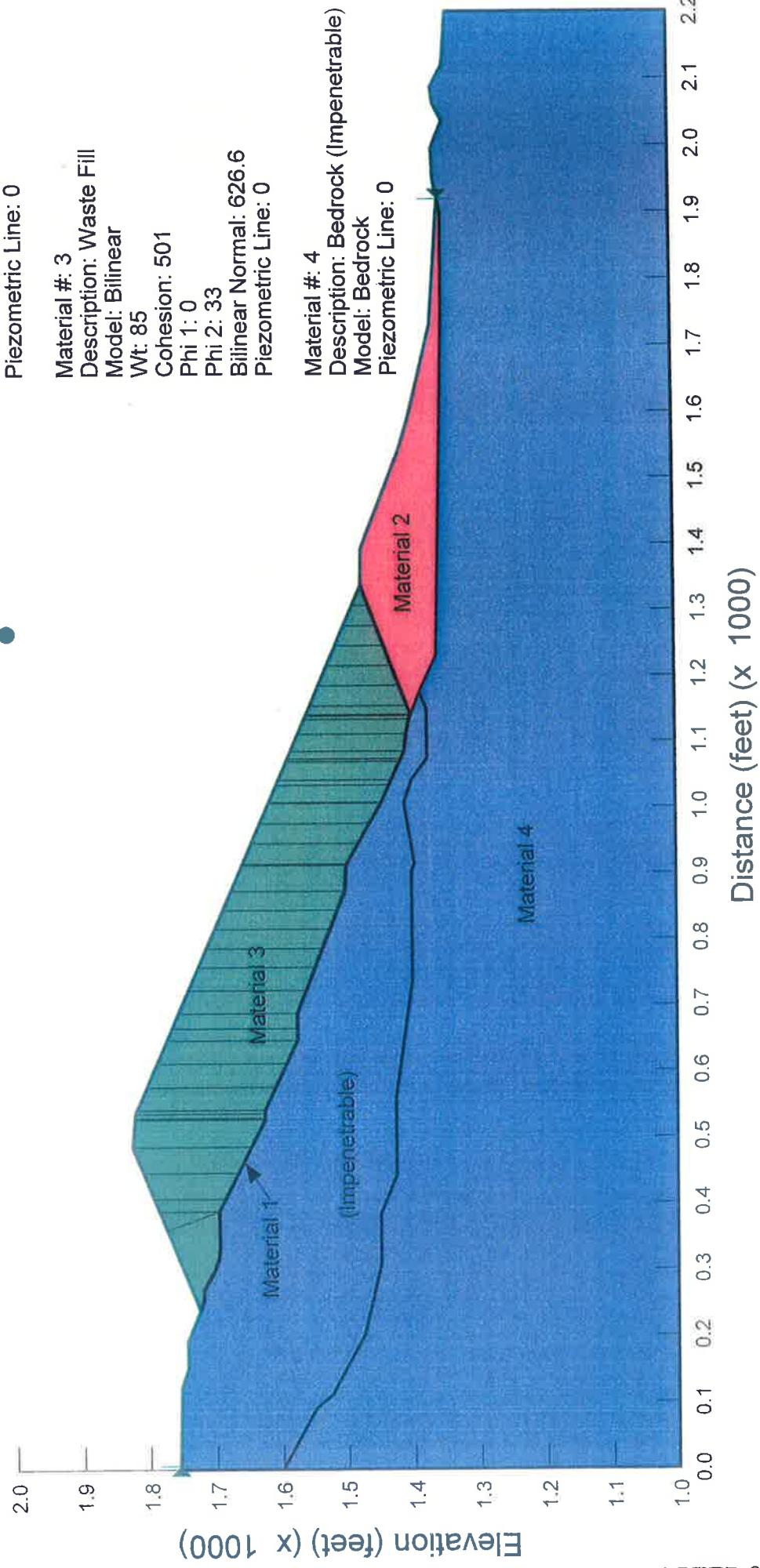


FIGURE 3-E

Sunshine Canyon Landfill
 Landslide Investigation, BAS Grades Section F-F'
 Sunshine_BAS_001_9_deg.gsz
 Date: 4/18/2008
 Time: 11:45:32 AM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0

Condition: BAS Original Design. Failure on new liner.

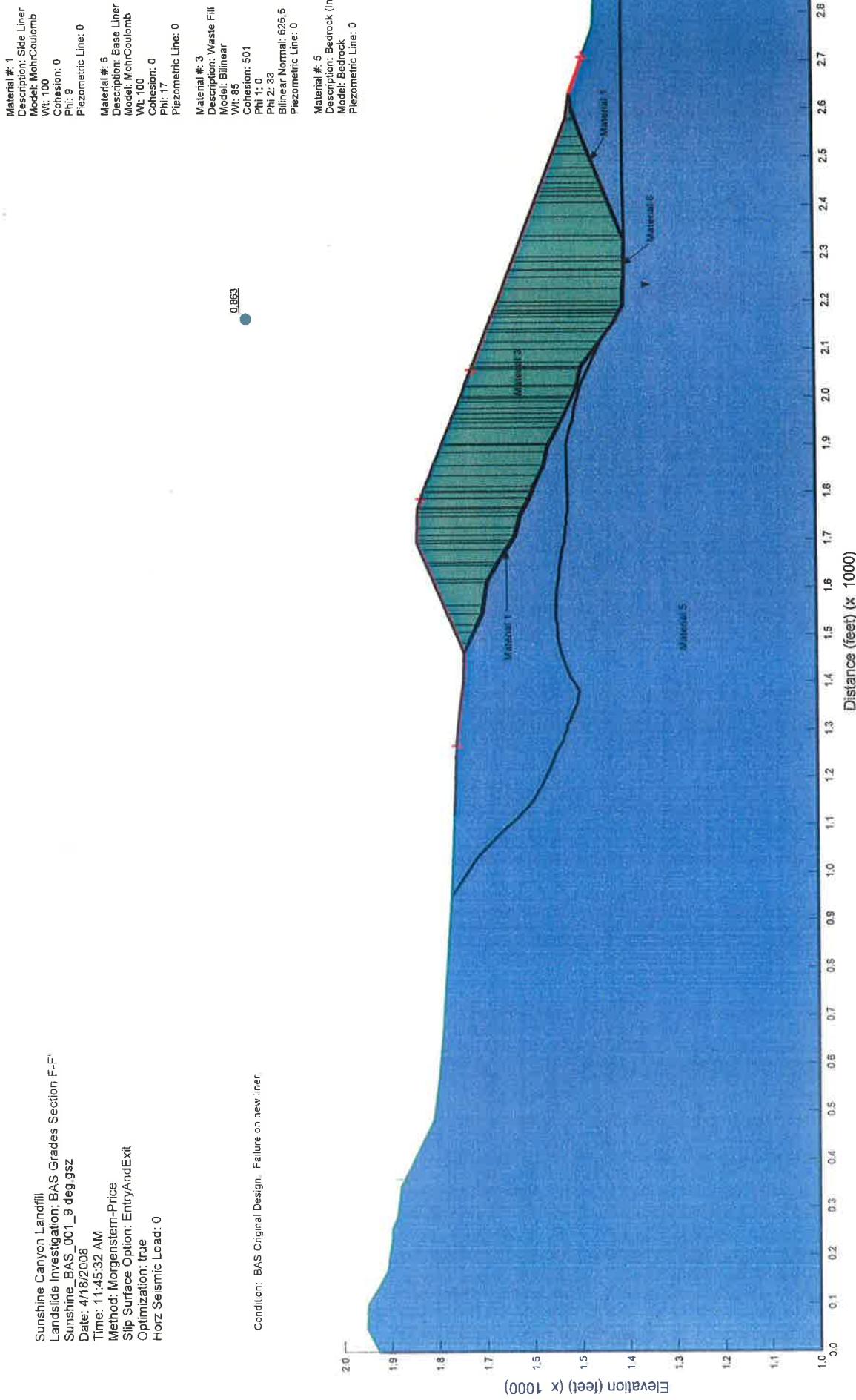


FIGURE 3-F

**WASTE-OVER-WASTE LINER STABILITY
NO “SAG”
DOUBLE-SIDED TEXTURED HDPE**

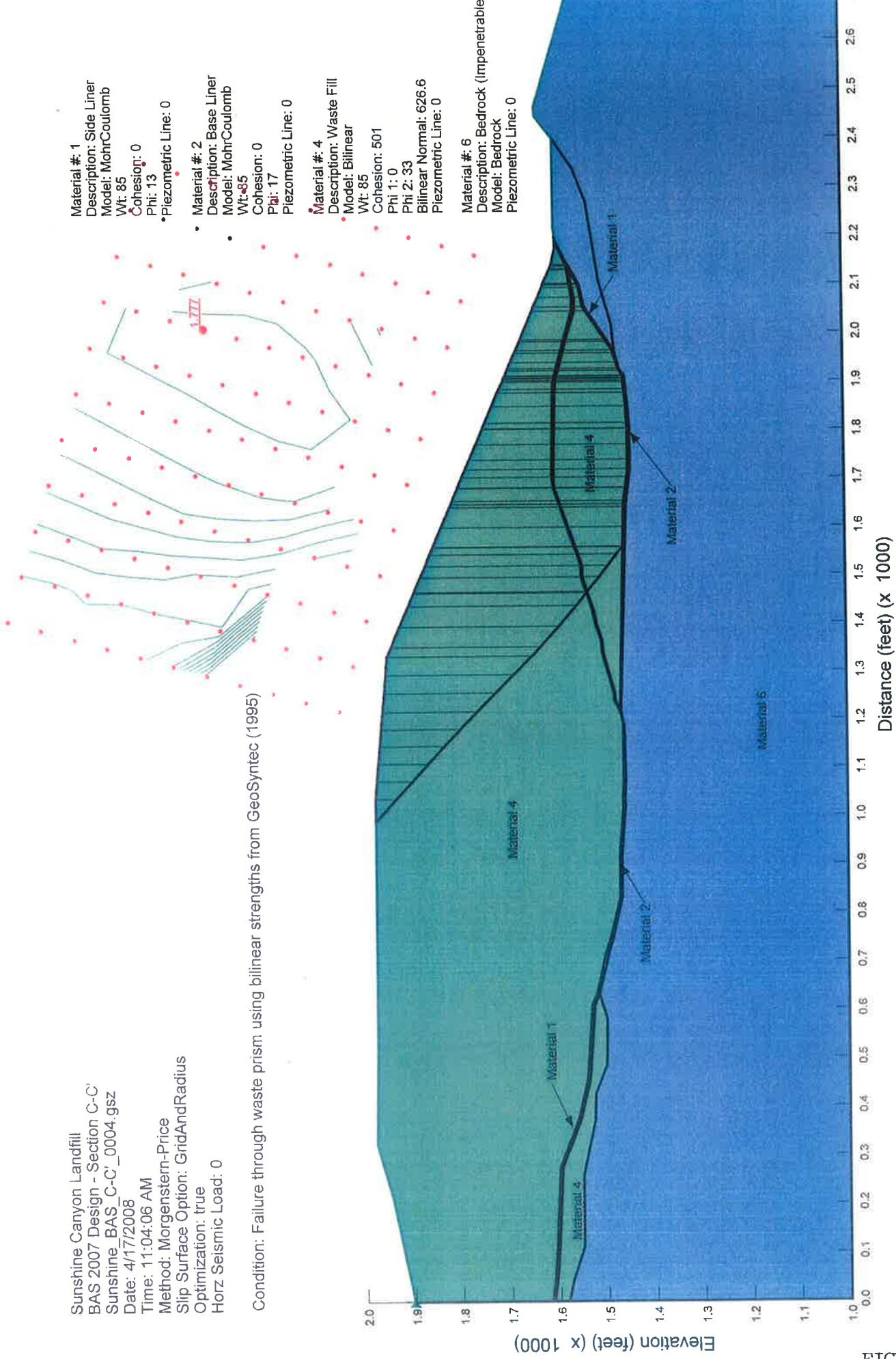


FIGURE 4-C

Sunshine Canyon Landfill
 BAS 2007 Design - Section D-D'
 Sunshine_BAS_D-D'_0003.gsz
 Date: 4/17/2008
 Time: 1:07:43 PM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0

Condition: Failure through waste prism using bilinear strengths from GeoSyntec (1995)

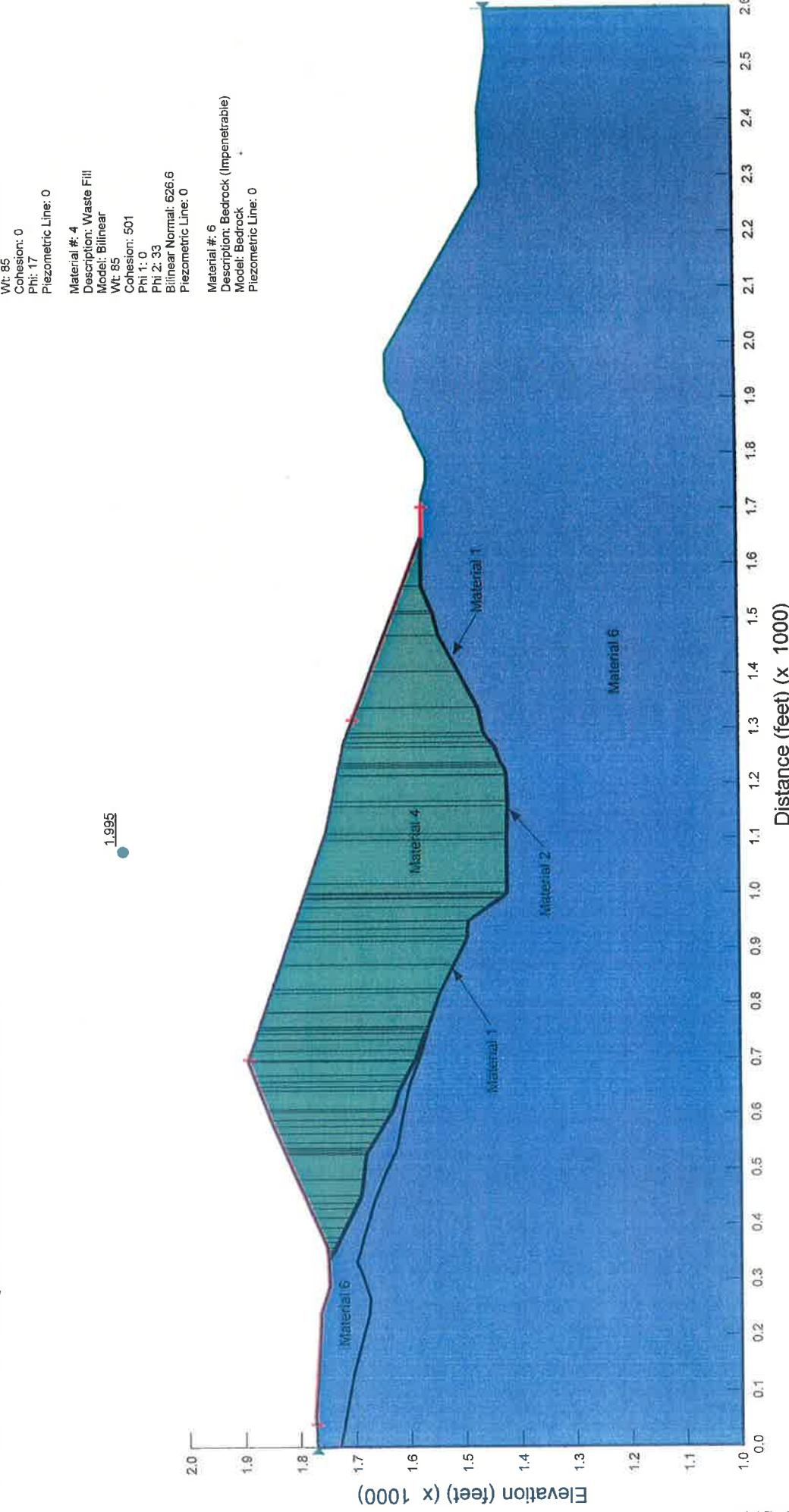


FIGURE 4-D

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section E-E"
 Sunshine_BAS_E-E'_0002_revised strength.gsz
 Date: 4/16/2008
 Time: 4:01:23 PM
 Method: Morgenstern-Price
 Slip Surface Option: AutoSearch
 Optimization: true
 Horz Seismic Load: 0

Condition: BAS Original Toe Buttress Design. Failure along new liner over old refuse.

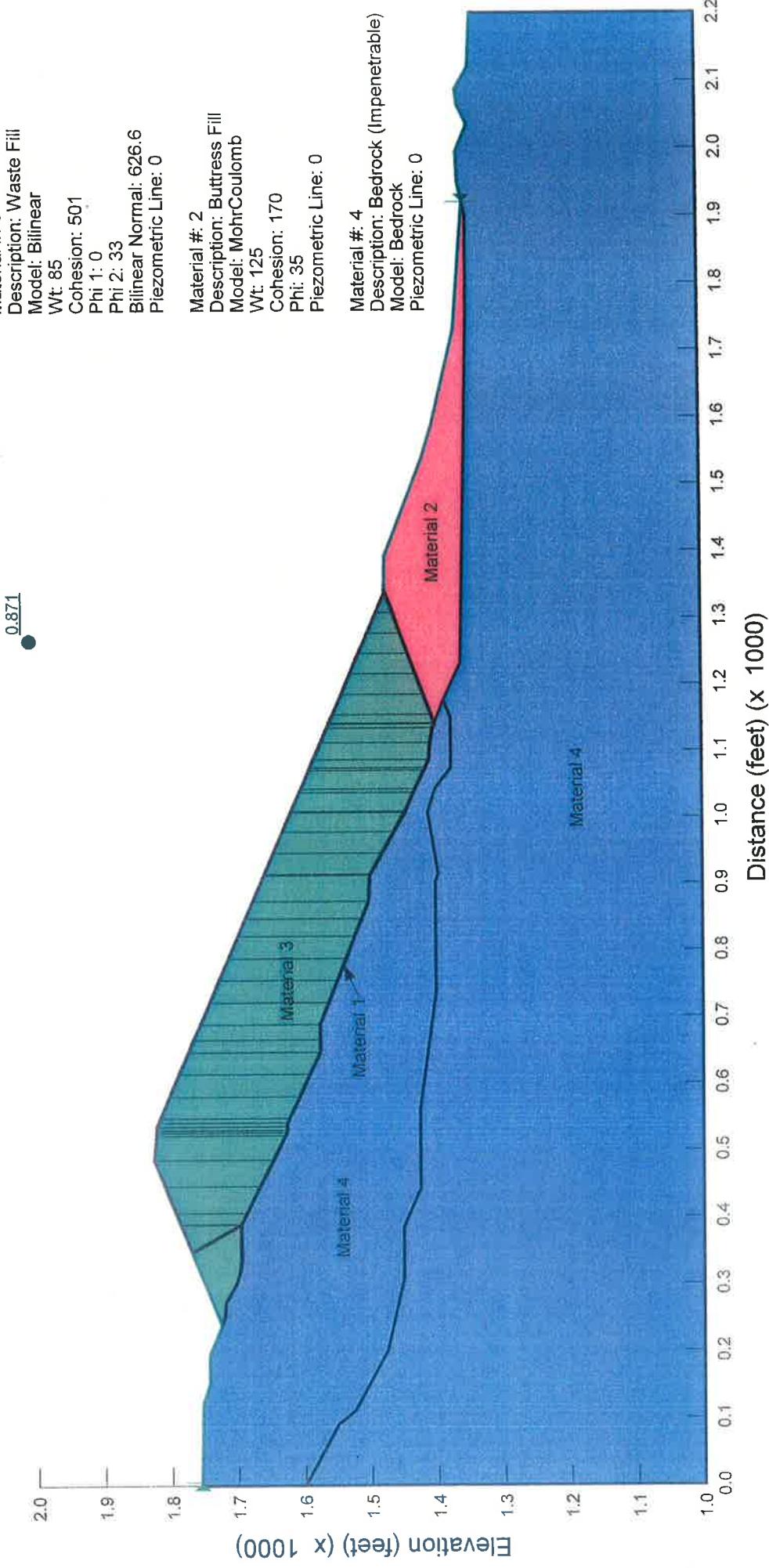


FIGURE 4-E

Sunshine Canyon Landfill
 Landslide Investigation; BAS Grades Section F-F'
 Sunshine_BAS_001.gsz
 Date: 4/16/2008
 Time: 9:07:29 AM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0
 Condition: BAS Original Design Failure on new liner

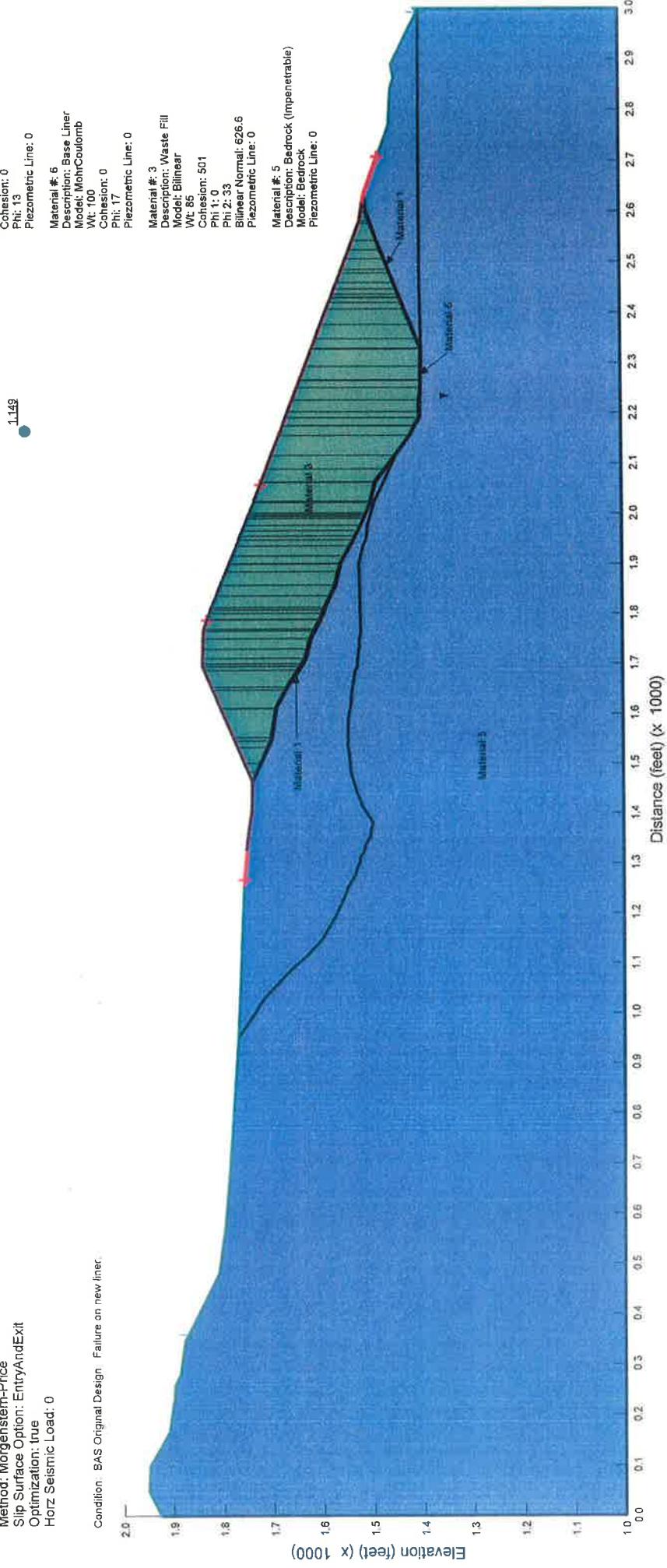


FIGURE 4-F

**WASTE-OVER-WASTE LINER STABILITY
“SAG”
DOUBLE-SIDED TEXTURED HDPE**

Sunshine Canyon Landfill
 BAS 2007 Design -Section C-C
 Sunshine_BAS_C-C_0007.qsz
 Date: 4/17/2008
 Time: 11:45:31 AM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0

Condition: Failure through waste prism using bilinear strengths from GeoSyntec (1995)

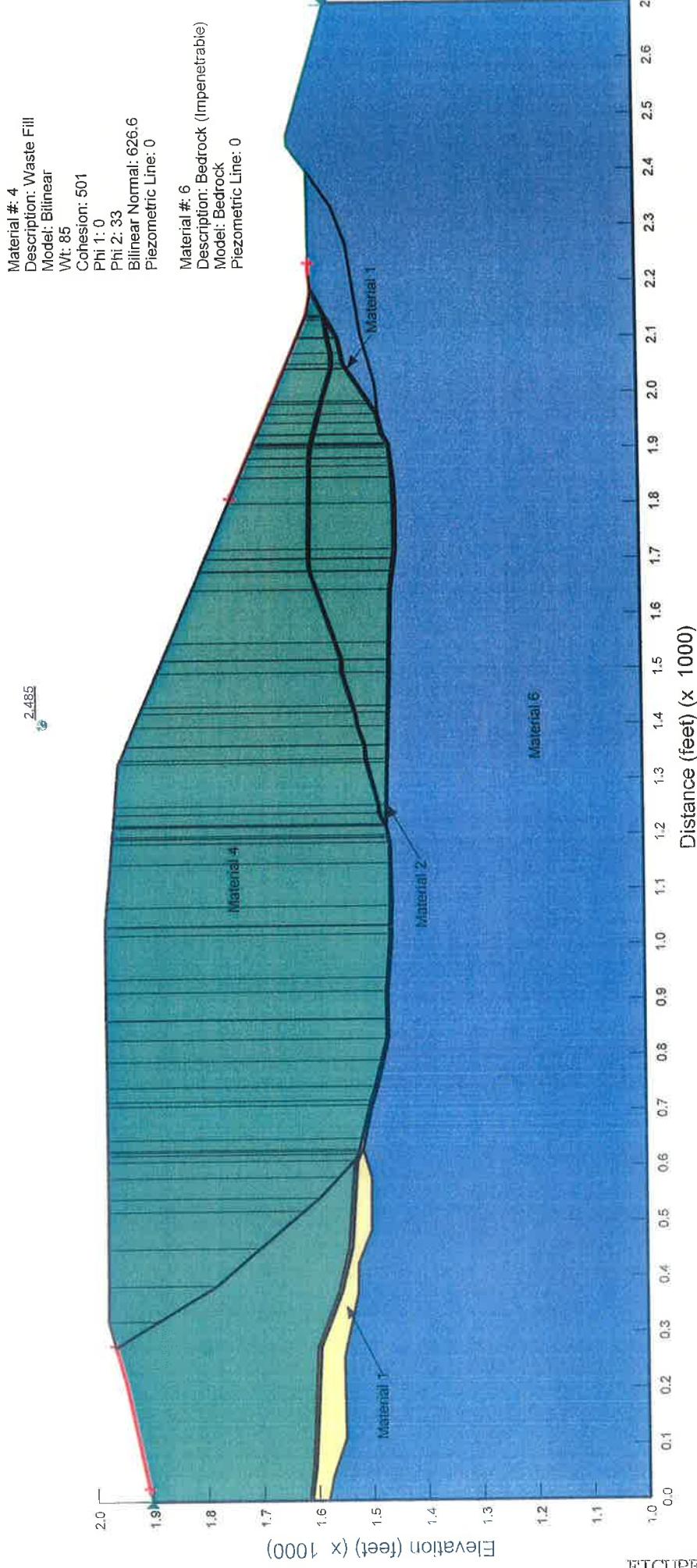


FIGURE 5-C

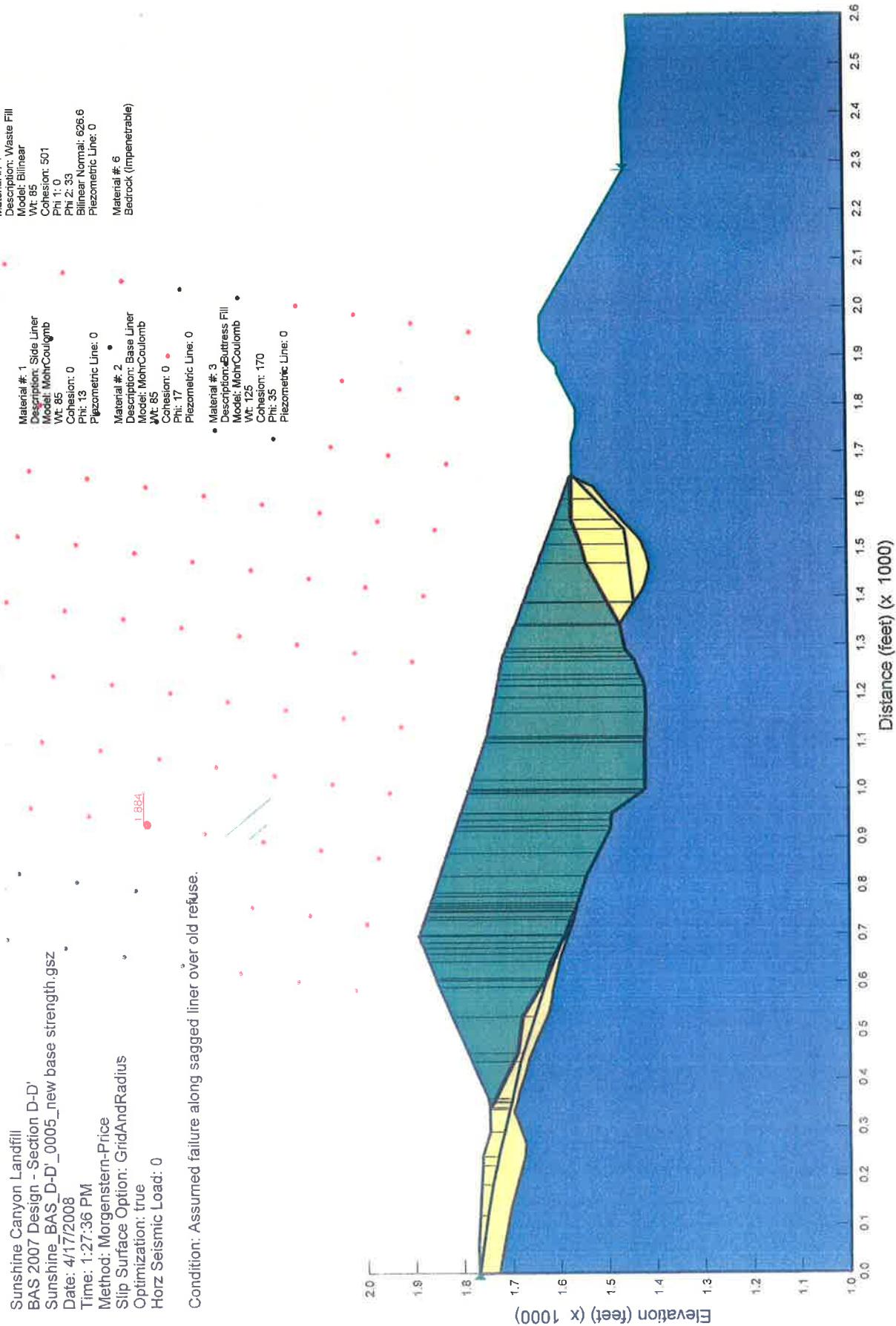


FIGURE 5-D

Sunshine Canyon Landfill
Landslide Investigation; GeoSyntec 2000 Section E-E"
Sunshine_GeoSyn_E-E'_0002_Orig Design_consolidated refuse.gsz
Date: 5/13/2008
Time: 3:03:53 PM
Method: Morgenstern-Price
Slip Surface Option: EntryAndExit
Optimization: true
Horz Seismic Load: 0

Material #: 1
Side Liner
Wt: 85
Phi: 13
C: 0

Material #: 2
Buttress Fill
Wt: 125
Phi: 35
C: 170

Material #: 3
Description: Waste Fill
Model: Bilinear
Wt: 85
Cohesion: 501
Phi 1: 0
Phi 2: 33
Bilinear Normal: 626.6
Piezometric Line: 0

Material #: 4
Bedrock (Impenetrable)

Condition: BAS Toe Buttress

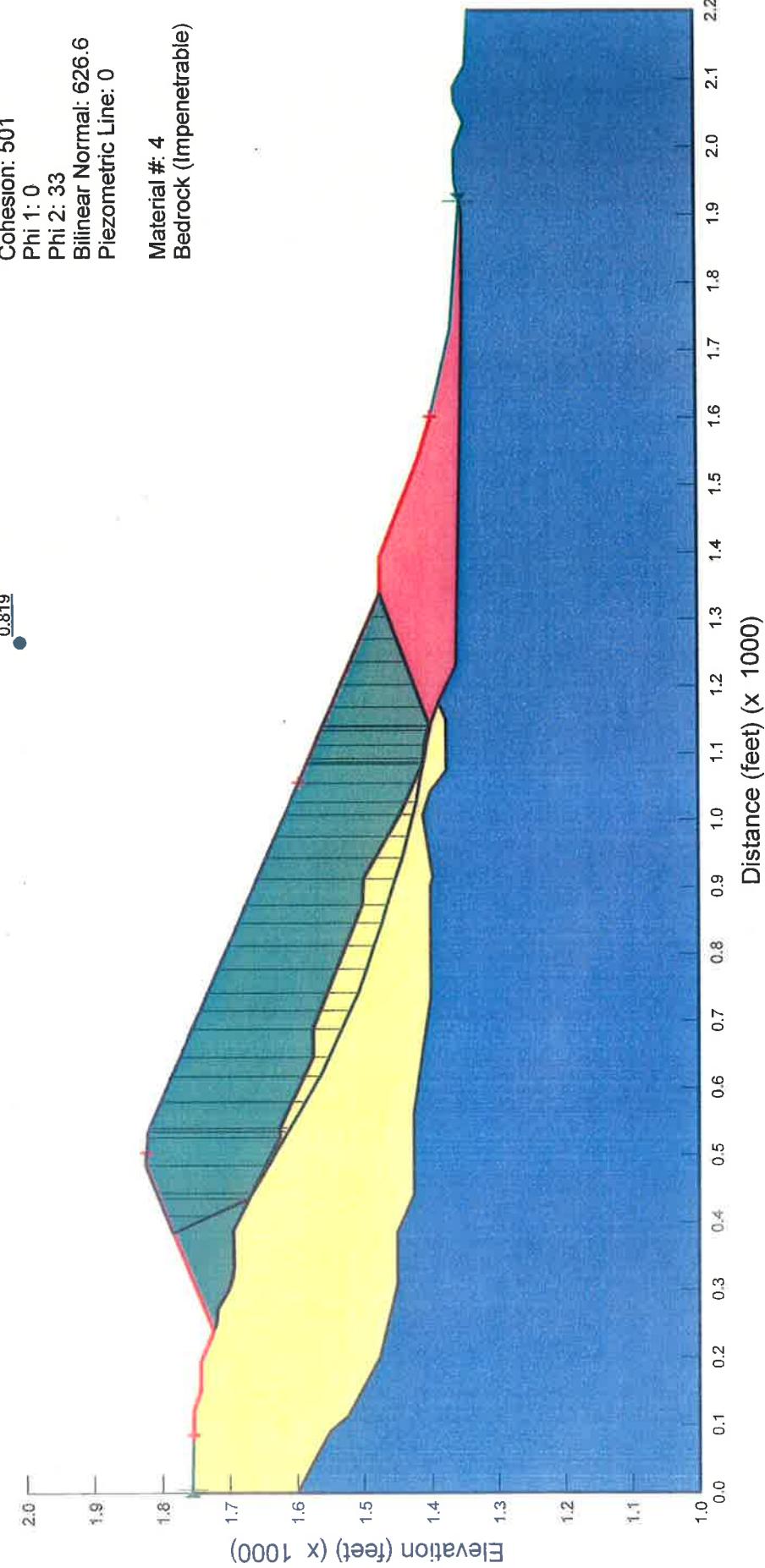


FIGURE -5-E

Sunshine Canyon Landfill
 Landslide Investigation; BAS Grades Section F-F'
 Sunshine; BAS_001_consolidated refuse.g2z
 Date: 5/13/2008
 Time: 3:44:17 PM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0

Condition: BAS Original Design Failure on new liner

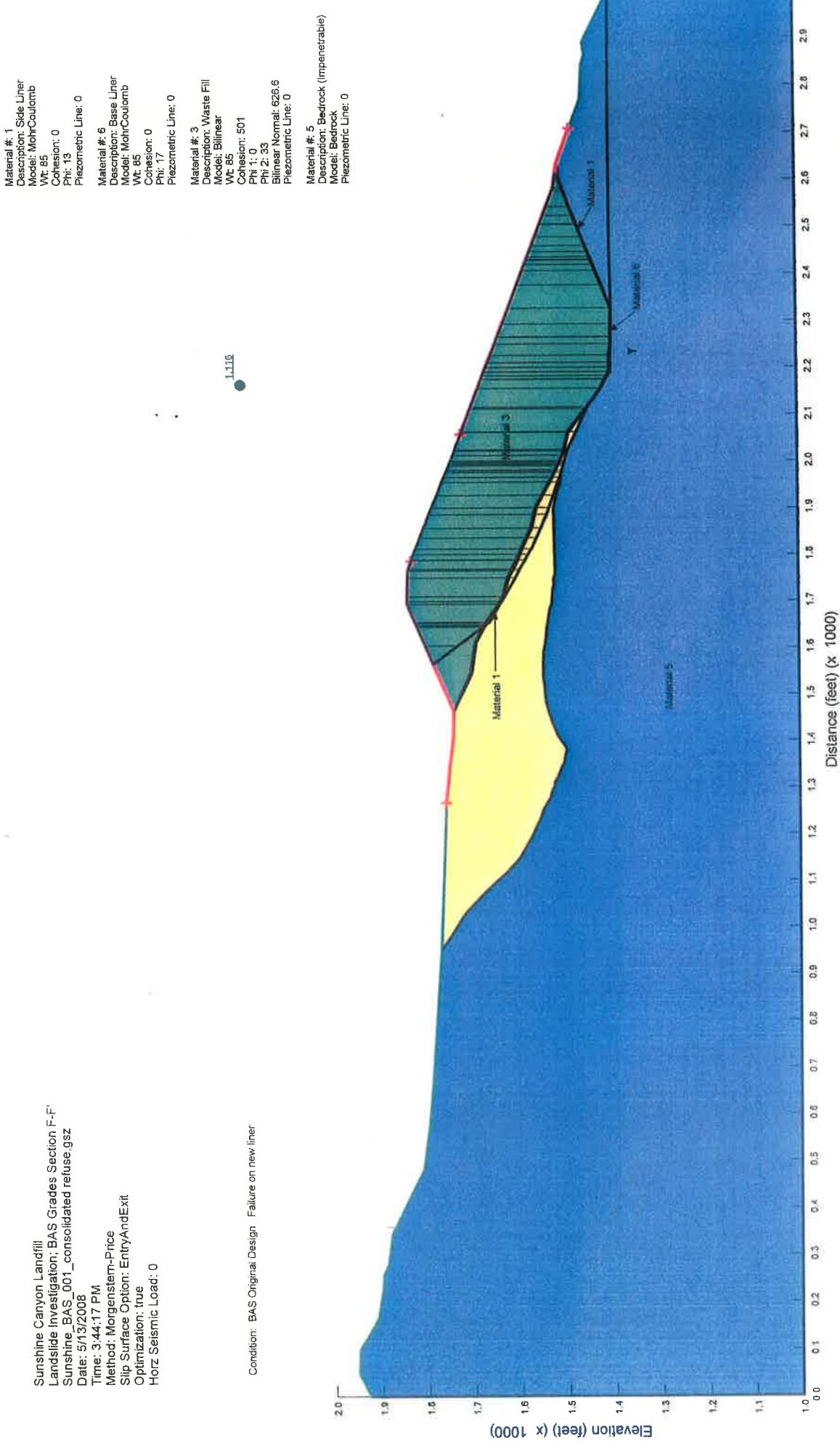


FIGURE 5-F

**STATIC STABILITY WITH
CONSOLIDATED TOE BERM FILL**

Sunshine Canyon Landfill
 Landslide Investigation; BAS Grades Section F-F'
 Sunshine_BAS_006_revised design_old refuse.gsz
 Date: 5/14/2008
 Time: 12:34:00 PM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0

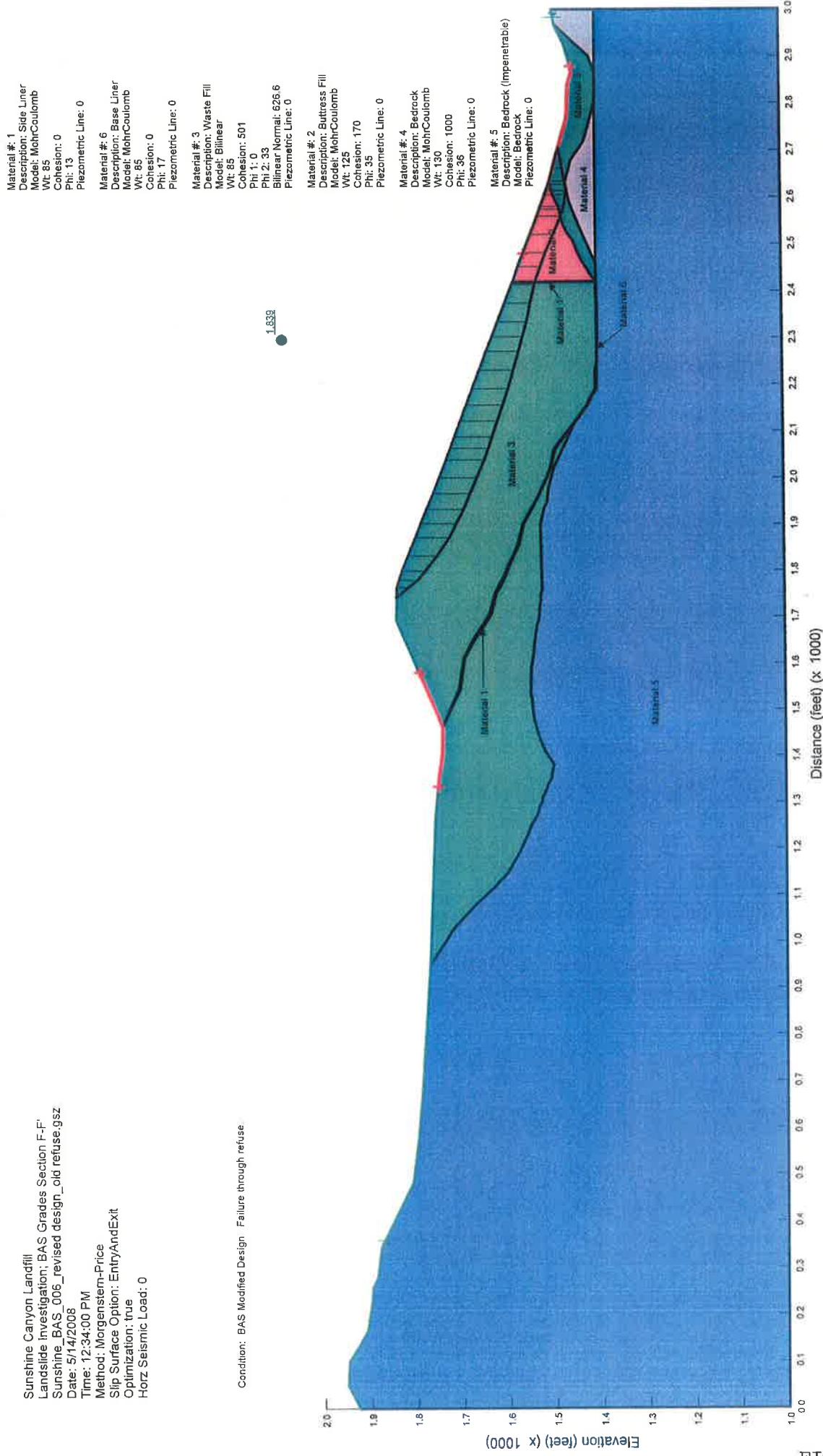


FIGURE 6-Fa

Sunshine Canyon Landfill
 Landslide Investigation; BAS Grades Section F-F'
 Sunshine_BAS_006_revised design_old refuse_reduced buttress strength.gsz
 Date: 5/4/2008
 Time: 12:46:03 PM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0

Condition: Modified design with membrane between buttress and new refuse cell. Failure through old refuse. Buttress strength reduced by 25% to account for refuse settlement.

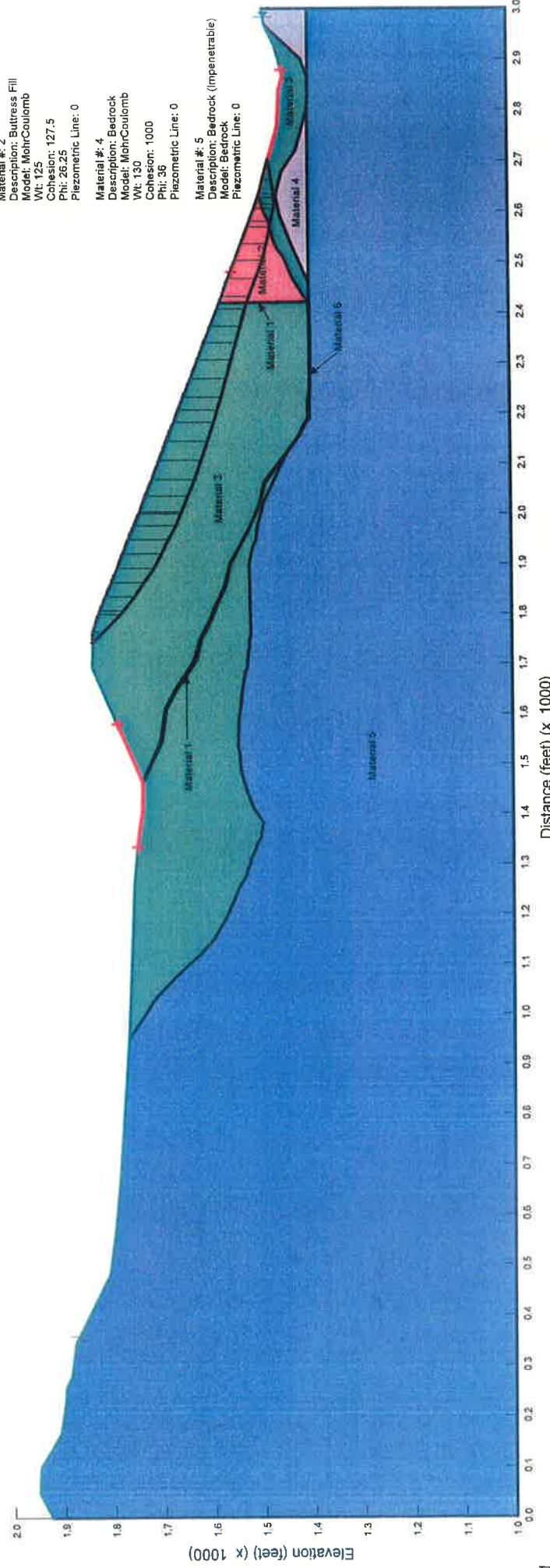


FIGURE 6-F'b

**STATIC STABILITY WITH
REMEDIAL DESIGN**

Sunshine Canyon Landfill
Landslide Investigation; GeoSyntec 2000 Section E-E'
BAS revised_E-E'_0002_revised strength_liner sag_remediated 7_membrane.gsz
Date: 5/13/2008
Time: 3:49:46 PM

Method: Morgenstern-Price
Slip Surface Option: EntryAndExit
Optimization: true
Horz Seismic Load: 0

Condition: BAS Modified Toe Buttress.

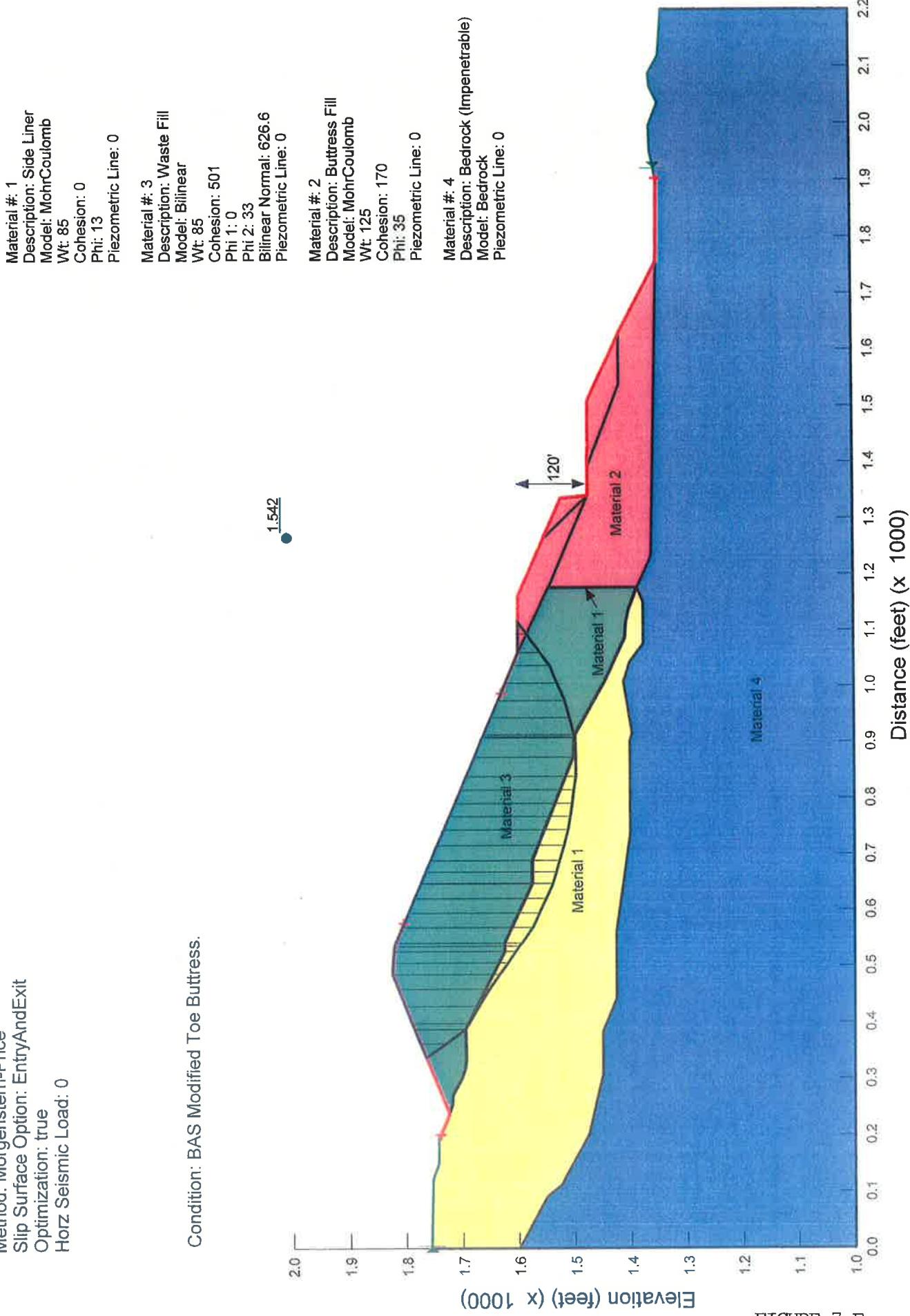


FIGURE 7-E

Sunshine Canyon Landfill
 Landslide Investigation; BAS Grades Section F-F'
 Sunshine_BAS_006_revised design_liner sag.gsz
 Date: 5/13/2008
 Time: 3:57:39 PM
 Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: True
 Horz Seismic Load: 0

Condition: BAS Modified Design: Assumed liner sag.

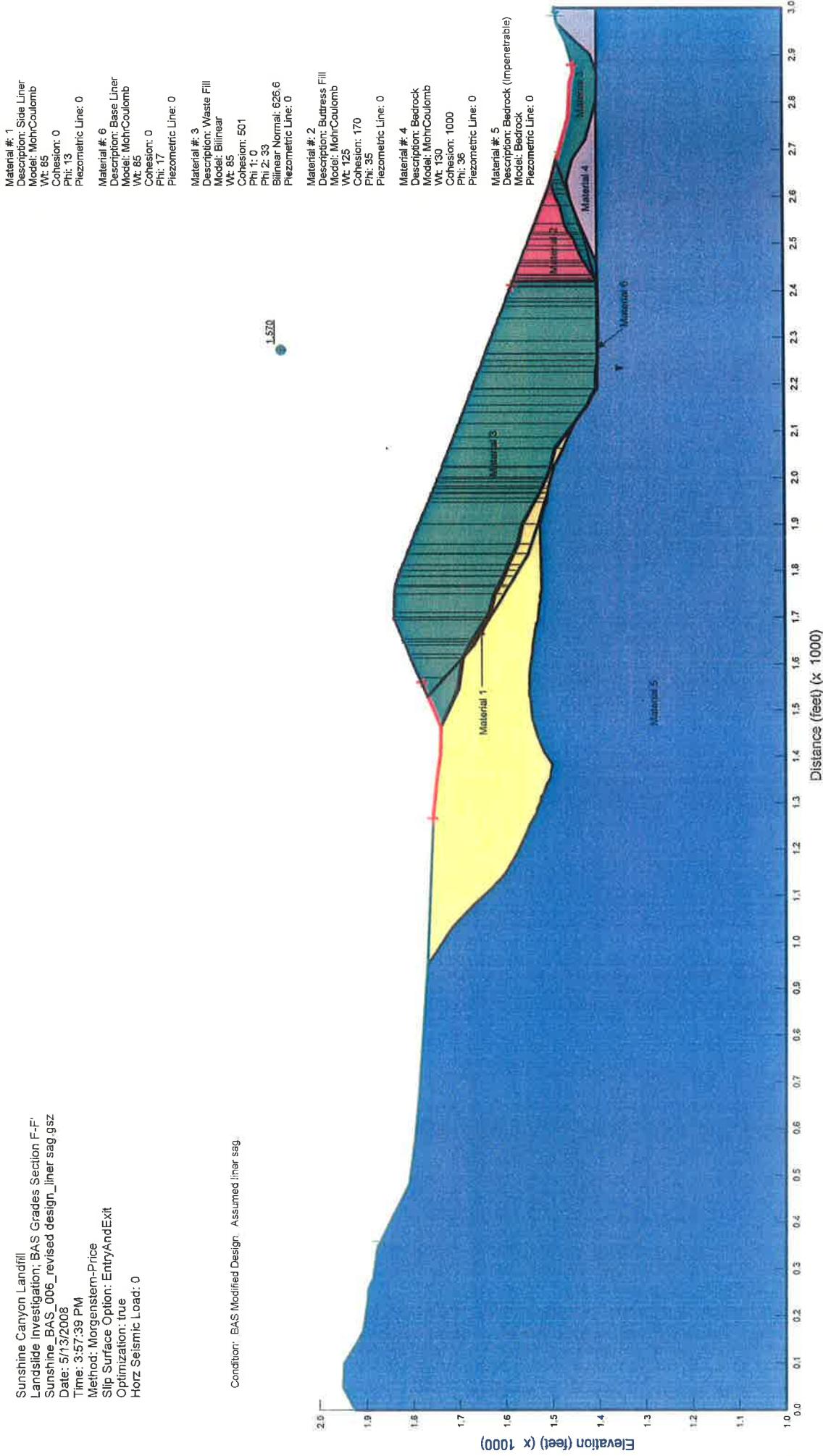


FIGURE 7-F

LINER OVER ALTERNATIVE COVER

Sunshine Canyon Landfill
 Landslide Investigation; GeoSyntec 2000 Section E-E"
 BAS revised_E-E'_0002_revised strength_membrane & cover_remediated 7_membrane_sag.gsz
 Date: 5/14/2008
 Time: 3:19:38 PM

Method: Morgenstern-Price
 Slip Surface Option: EntryAndExit
 Optimization: true
 Horz Seismic Load: 0

Condition: Modified toe buttress with membrane along interface. Refuse consolidation below liner and alternative final cover.
 Cover strength reduced by 25% due to consolidation of underlying refuse.

Material #: 1
 Description: Side Liner
 Model: MohrCoulomb
 Wt: 85
 Cohesion: 0
 Phi: 13
 Piezometric Line: 0

Material #: 3
 Description: Waste Fill
 Model: Bilinear
 Wt: 85
 Cohesion: 501
 Phi 1: 0
 Phi 2: 33
 Bilinear Normal: 626.6
 Piezometric Line: 0

Material #: 2
 Description: Buttress Fill
 Model: MohrCoulomb
 Wt: 125
 Cohesion: 170
 Phi 1: 0
 Phi 2: 35
 Piezometric Line: 0

Material #: 4
 Description: Alternative Final Cover
 Model: Bedrock
 Wt: 125
 Cohesion: 127.5
 Phi: 26.25
 Piezometric Line: 0

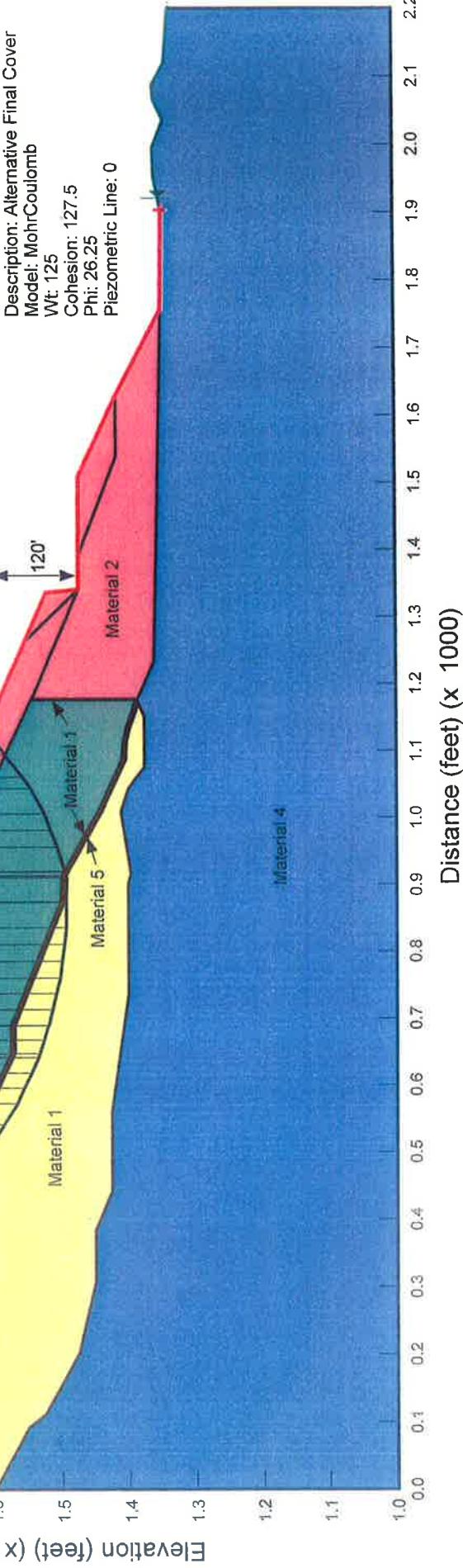


FIGURE 8-E

ATTACHMENT 2

SEISMIC WASTE DISPLACEMENT CALCULATIONS

CALCULATION OF YIELD ACCELERATIONS

Sunshine Canyon Landfill
 BAS 2007 Design - Section C-C'
 Sunshine BAS C-C_0004_9 deg_Ky.gsz
 Date: 4/18/2008
 Time: 11:13:59 AM
 Method: Morgenstern-Price
 Slip Surface Option: GridAndRadius
 Optimization: true
 Horz Seismic Load: 0.2

Condition: 9 deg side slope friction angle. Determination of Ky

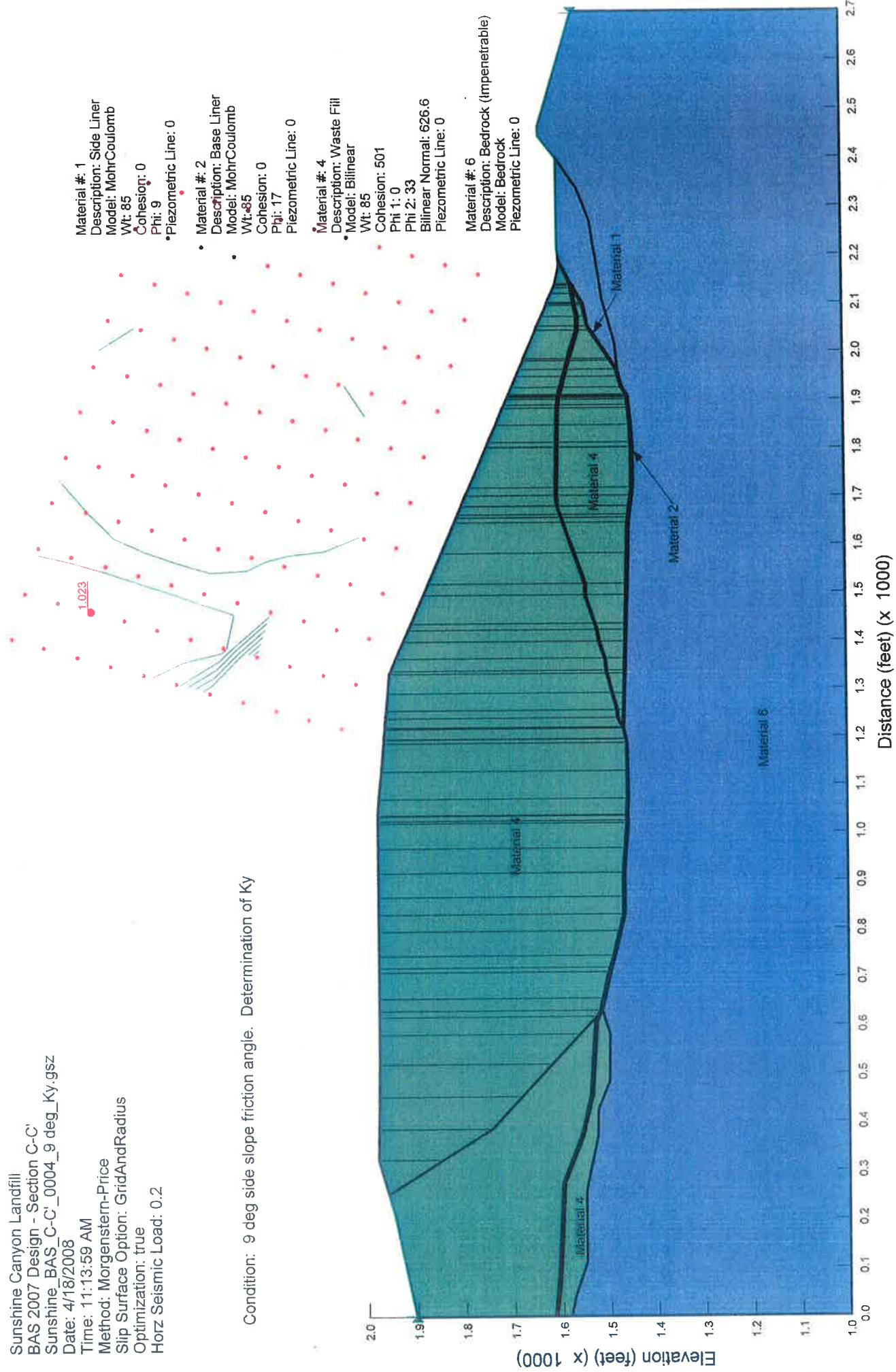


FIGURE 9-C

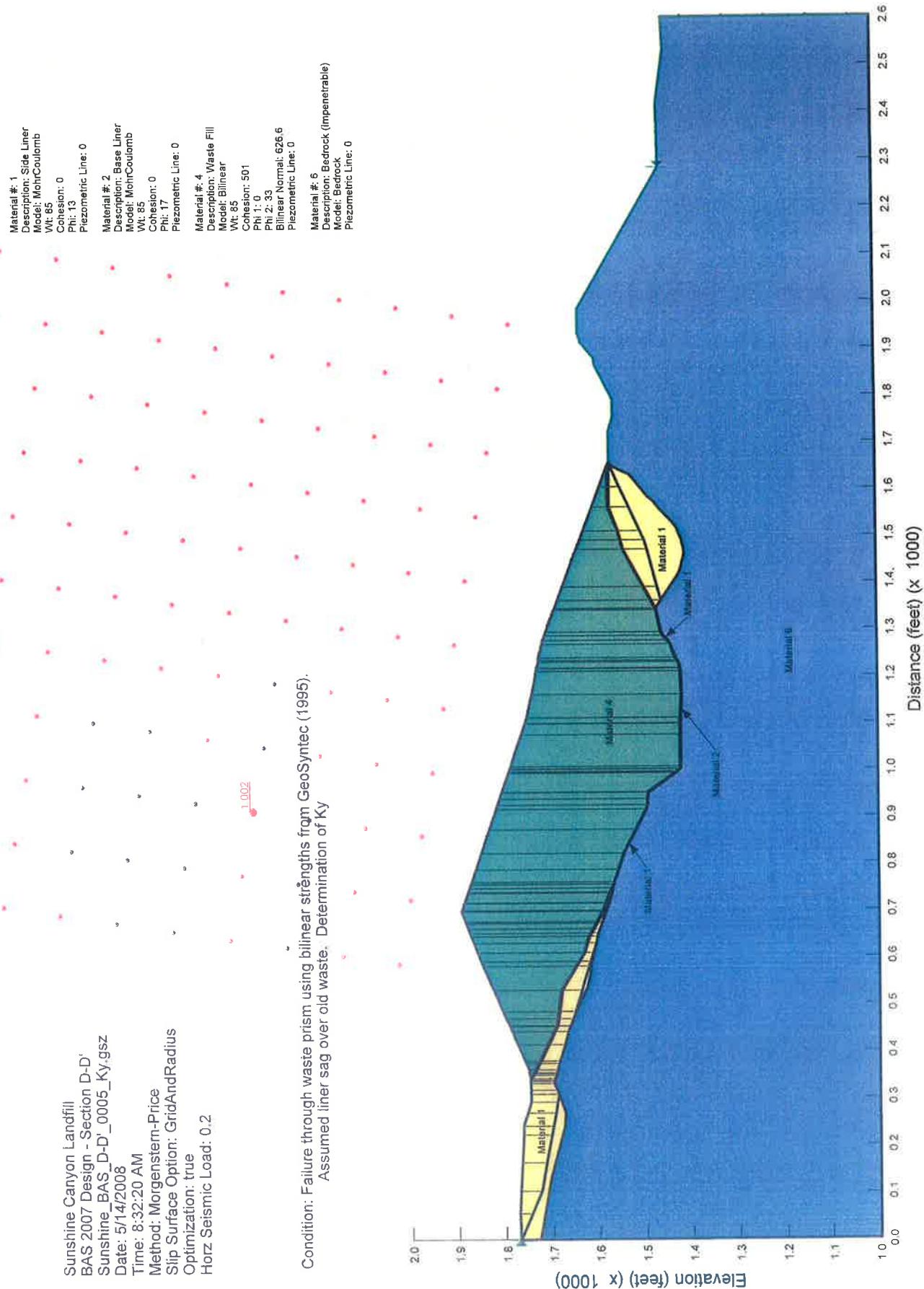


FIGURE 9-D

Sunshine Canyon Landfill
Landslide Investigation; GeoSyntec 2000 Section E-E"
BAS revised E-E'_0002_revised strength_liner sag_remediated 7_membrane_Ky.gsz

Date: 5/14/2008

Time: 8:38:04 AM

Method: Morgenstern-Price

Slip Surface Option: EntryAndExit

Optimization: true

Horz Seismic Load: 0.16

Material #: 1
Description: Side Liner
Model: MohrCoulomb
Wt: 85
Cohesion: 0
Phi: 13
Piezometric Line: 0

Material #: 3
Description: Waste Fill
Model: Bilinear
Wt: 85
Cohesion: 501
Phi 1: 0
Phi 2: 33
Bilinear Normal: 626.6
Piezometric Line: 0

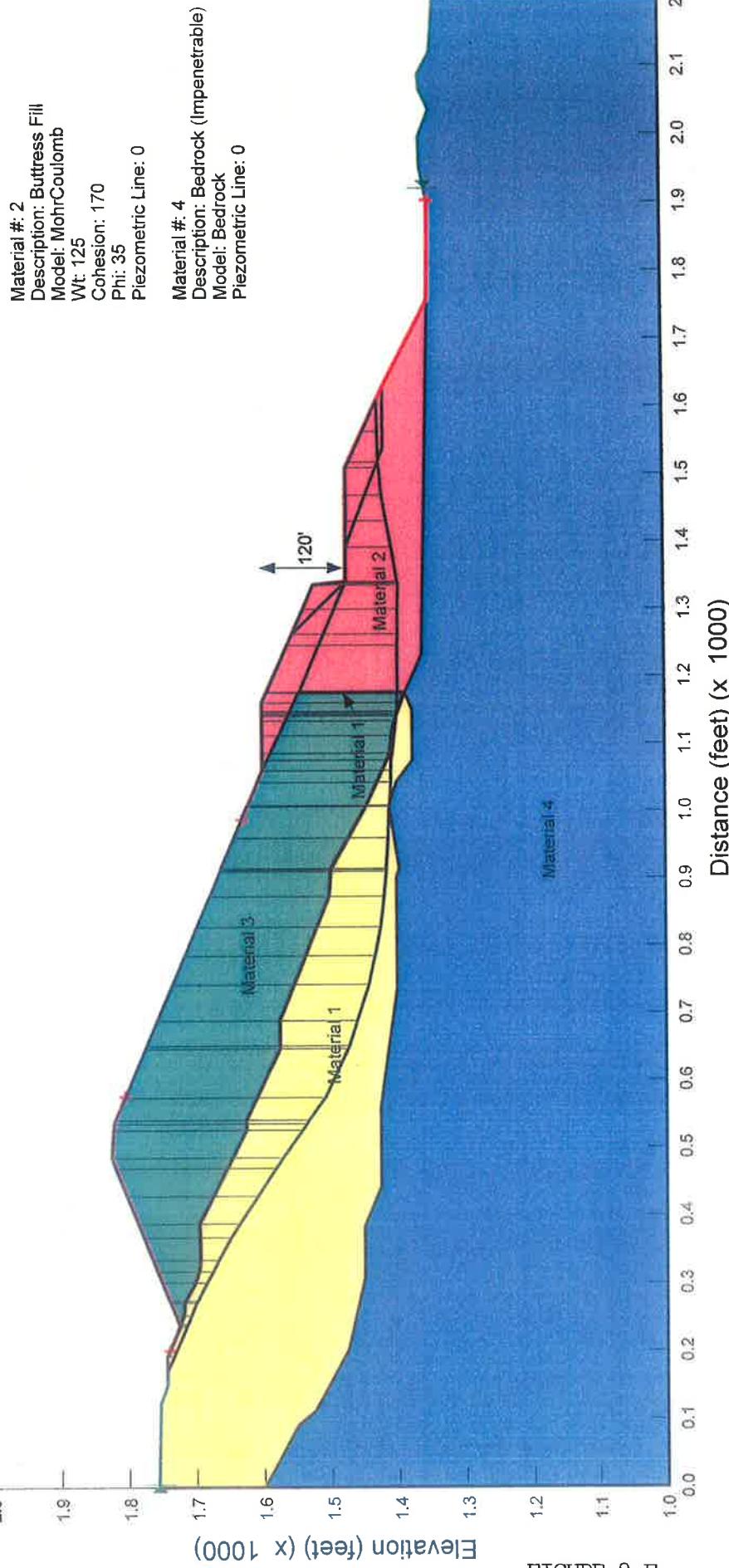


FIGURE 9-E

Sunshine Canyon Landfill
 Landslide Investigation; BAS Grades Section F-F'
 Sunshine_BAS_006_revised design_liner sag_Ky gsz
 Date: 5/14/2008
 Time: 8:56:59 AM
 Method: Morgenstern-Price
 Slip Surface Option: EnhyAndExit
 Optimization: true
 Horz Seismic Load: 0.19

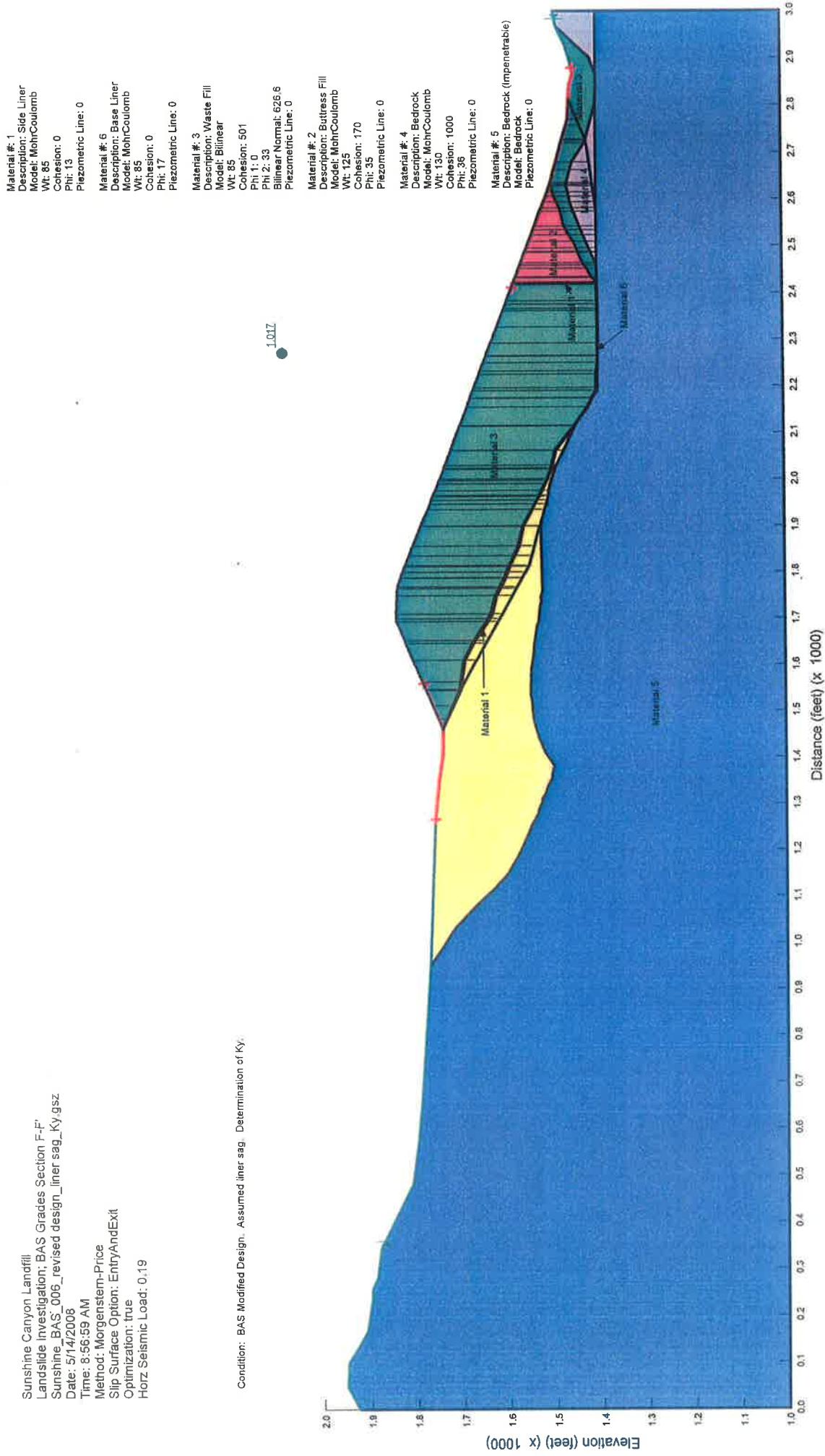


FIGURE 9-F

DISPLACEMENT CALCULATIONS

Table 1

Seismically-Induced Permanent Deformation Calc. Check
Cross Section C-C'

H =	520 ft =	158.496 m
EQ mag =	6.9	
Ky =	0.2	
MHA =	0.81	
NRF =	0.74	
Tm =	0.5	
D5-95 =	14	

VsAvg = V0 + V1 =	315 m/s =	1033.465 ft/s
V0 =	130	
V1 =	500	

Ts = 2.013 sec.

Ts/Tm =	4.025295	
MHEA/(MHArock x NRF) =	0.12	Bray & Rathje., Figure 7(b)
Kmax =	0.072 g	
Ky/Kmax =	2.777778	

Normalized Displacement, $U/(k_{max} \times D_{5-95}) =$ 0.001 Bray & Rathje., Figure 11

Displacement, $U = [U/(k_{max} \times D_{5-95})] \times k_{max} \times D_{5-95} =$ 0.0 cm
0.0 inches

Table 2

Seismically-Induced Permanent Deformation Calc. Check
Cross Section D-D'

H =	350 ft =	106.68 m
EQ mag =	6.9	
Ky =	0.2	
MHA =	0.81	
NRF =	0.74	
Tm ≈	0.5	
D5-95 =	14	

VsAvg = V0 + V1 =	275 m/s =	902.231 ft/s
V0 =	130	
V1 =	420	

Ts = 1.552 sec.

Ts/Tm =	3.103418
MHEA/(MHArock x NRF) =	0.16 Bray & Rathje., Figure 7(b)
Kmax =	0.096 g
Ky/Kmax =	2.083333

Normalized Displacement, U/(k_{max} × D₅₋₉₅) = 0.001 Bray & Rathje., Figure 11

Displacement, U = [U/(k_{max} × D₅₋₉₅)] × k_{max} × D₅₋₉₅ = 0.0 cm
0.0 inches

Table 3

Seismically-Induced Permanent Deformation Calc. Check
Cross Section E-E'

H =	300 ft =	91.44 m
EQ mag =	6.9	
Ky =	0.16	
MHA =	0.81	
NRF =	0.74	
Tm =	0.5	
D5-95 =	14	

VsAvg = V0 + V1 =	262.5 m/s =	861.2205 ft/s
V0 =	130	
V1 =	395	

Ts = 1.393 sec.

Ts/Tm =	2.786743	
MHEA/(MHArock x NRF) =	0.17	Bray & Rathje., Figure 7(b)
Kmax =	0.102 g	
Ky/Kmax =	1.568627	

Normalized Displacement, U/(k _{max} × D ₅₋₉₅) =	0.001	Bray & Rathje., Figure 11
----------------------------------------------------------------------	-------	---------------------------

Displacement, U = [U/(k _{max} × D ₅₋₉₅)] × k _{max} × D ₅₋₉₅ =	0.0 cm	
	0.0 inches	

Table 4

Seismically-Induced Permanent Deformation Calc. Check
Cross Section F-F'

H =	275 ft =	83.82 m
EQ mag =	6.9	
Ky =	0.19	
MHA =	0.81	
NRF =	0.74	
Tm =	0.5	
D5-95 =	14	

VsAvg = V0 + V1 =	255 m/s =	836.6142 ft/s
V0 =	130	
V1 =	380	

Ts = 1.315 sec.

Ts/Tm =	2.629647	
MHEA/(MHArock x NRF) =	0.17	Bray & Rathje., Figure 7(b)
Kmax =	0.102 g	
Ky/Kmax =	1.862745	

Normalized Displacement, $U/(k_{\max} \times D_{5-95}) =$ 0.001 Bray & Rathje., Figure 11

Displacement, $U = [U/(k_{\max} \times D_{5-95})] \times k_{\max} \times D_{5-95} =$ 0.0 cm
0.0 inches

ATTACHMENT 3

COVER STABILITY & SEISMIC DEFORMATION CALCULATION

STATIC STABILITY CALCULATIONS

Sunshine Canyon Landfill City-County JTD Cover Stability
Geogrid-Reinforced HDPE Liner Cover Stability

2/27/2006

RMW

Slope Parameters						Computed Forces / Unit Width Resisting:				Soil Cohesion Assigned Safety Factor			Factor of Safety:		
Sat. Unit Wt.	Int. Friction Angle	Passive Friction Angle	Slope Ratio (H:1V)	Interface Friction Angle	Soil Thickness	Soil Slope	Total Length	Ave. Wedge Fail. Length	Driving Soil Load	Toe Soil Wedge	Tensile Demand		$T_u = T_u / SF_A$	$FS = (R_u + R_f + R_c + T_u) / D_s$	
											Interface Friction	Fiction			
120	35	27.5	1.5	2	26.57	1	40	89.5	1	0.666866867	2.17	4800	107.6	2572.5	4519.9
															1.55
															4737

Notes:

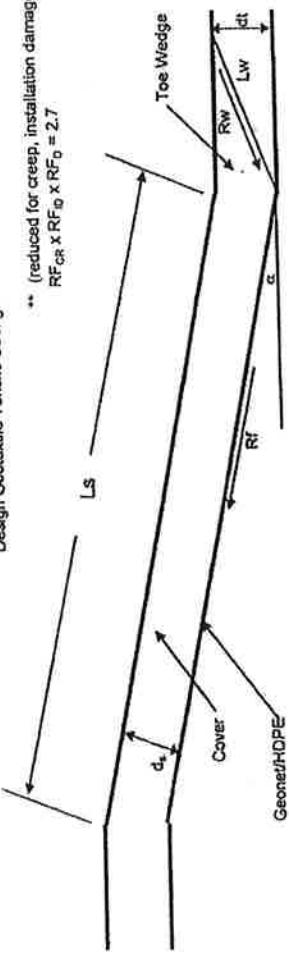
Conditions:
 1 foot thick cover soil on geogrid-reinforced geomembrane/textured HDPE liner
 Interface between geonet and GCL

Cover Profile

1-foot-thick soil cover
 Geogrid
 Geocomposite
 Textured HDPE liner
 Low-Permeability Soil Layer
 Geocomposite (Gas; optional)
 2-foot-thick foundation layer
 Waste

40-mil. Textured Very-Flexible Geomembrane
 Geocomposite Drainage Layer
 Geogrid
 Design Geotextile Tensile Strength Long-Term Design Strength**
 RFc_g x RFf_g x RFd = 2.7 147 lb/ft
 RFc_a x RFf_a x RFd = 2.7 200 lb/ft
 4390 lb/ft 4737 lb/ft
 Tensar UX1700HS or equivalent

** (reduced for creep, installation damage, and durability)



DISPLACEMENT CALCULATIONS

Sunshine Canyon Landfill City-County JTD Cover Stability
Geogrid-Reinforced HDPE Liner Cover Stability

2/27/2008 RMW

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Interface Friction Angle δ	Slope Inclination α	Apparent Interface Cohesion, cL_s lbs/ft	Yield Acceleration K_y^*	Waste Fill Height ft	Maximum Calculated Displacement*** (inches)
Interface between geonet and GCL					
15	26.57	4737	0.44	150 500	2 inches No Deformation

Case:

1 foot thick cover soil on geogrid-reinforced geonet/textured HDPE liner

Interface between geonet and GCL	$L_s = 89.48$	$K_y = 0.44$	g lbs/ft; value $\times 1.5$ since no creep for short-term EQ load

Notes:

*Solve for T_u and K_y when $FS=1.00$

$$**FS = \frac{((\gamma_s \delta L_s \cos \alpha) - (K_y \gamma_s \delta L_s \sin \alpha))(\tan \delta) + cL_s}{(\gamma_s \delta L_s \sin \alpha + K_y \gamma_s \delta L_s \cos \alpha)}$$

**Equation adapted from Kramer, 1996, Geotechnical Earthquake Engineering, pg 434
Variables defined on previous page

***Calculated Seismically-Induced Permanent Cover Deformation per Bray and Rathje (1998)
See sheets 3 and 4 of 4

Sunshine City-County JTD Cover Stability_rev1.xlsYIELD CALC - 3/20/2008

Sunshine Canyon Landfill City-County JTD Cover Stability
Geogrid-Reinforced HDPE Liner Cover Stability

2/27/2008

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Analyses per: Bray, J.D., and Rathje, E.M., 1998, "Earthquake-Induced Displacements of Solid-Waste Landfills," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, March, Vol. 124, No. 3.

Waste Fill Height	H =	150 ft =	45.72 m
Earthquake Magnitude	EQ mag =	6.7	
Yield Acceleration	Ky =	0.44	From Stability Analysis
Maximum Horizontal Acceleration of Rock	MHARock =	1.06	
Non-Linear Response Factor	NRF =	0.71	Bray & Rathje (1998), Figure 6b
EQ Motion Mean Period	Tm =	0.48	Bray et al. (1998), Figure 2b
Significant Duration	D5-95 =	12	Bray et al. (1998), Figure 2c
Waste Shear Wave Velocity	VsAvg = V0 + V1 =	210 m/s =	688.9764 ft/s
@ top	V0 =	130	Bray & Rathje (1998), Figure 2
@ depth	V1 =	290	
Fundamental Period of Waste Fill	Ts =	0.871 sec.	
Waste Max. Equivalent Accel./Rock Accel.	Ts/Tm =	1.814286	
Max. Horiz. Equiv. Accel. of Waste	MHEA/(MHARock x NRF) =	0.79	Bray & Rathje (1998), Figure 8b
	Kmax =	0.595 g	
	Ky/Kmax =	0.739496	
Cover Displacement, U =	4.0 cm	1.6 inches	Bray & Rathje (1998), Figure 13

Sunshine Canyon Landfill City-County JTD Cover Stability
Geogrid-Reinforced HDPE Liner Cover Stability

2/27/2008

RMW

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Analyses per: Bray, J.D., and Rathje, E.M., 1998, "Earthquake-Induced Displacements of Solid-Waste Landfills," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, March, Vol. 124, No. 3.

Waste Fill Height	H =	500 ft =	152.4 m
Earthquake Magnitude	EQ mag =	6.7	From Stability Analysis
Yield Acceleration	Ky =	0.44	
Maximum Horizontal Acceleration of Rock	MHARock =	1.06	
Non-Linear Response Factor	NRF =	0.71	Bray & Rathje (1998), Figure 6b
EQ Motion Mean Period	Tm =	0.48	Bray et al. (1998), Figure 2b
Significant Duration	D5-95 =	12	Bray et al. (1998), Figure 2c
Waste Shear Wave Velocity @ top	VsAvg = V0 + V1 =	315 m/s =	1033.465 ft/s
@ depth	V0 = 130	Bray & Rathje (1998), Figure 2	
	V1 = 500		
Fundamental Period of Waste Fill	Ts =	1.935 sec.	
Waste Max. Equivalent Accel./Rock Accel. Max. Horiz. Equiv. Accel. of Waste	Ts/Tm =	4.031746	Bray & Rathje (1998), Figure 8b
	MHEA/(MHARock x NRF) =	0.57	
	Kmax =	0.429 g.	
	Ky/Kmax =	1.025641 > 1.0, so no deformation	
Cover Displacement, U =	0.0 cm 0.0 inches	Bray & Rathje (1998), Figure 13	

ATTACHMENT 4

LEA E-MAIL OF MARCH 27, 2008

Gary Lass

From: <etseng@aol.com>
To: <pwillman@bas.com>; <smarkie@CIWMB.ca.gov>; <Tony.Pelletier@awin.com>
Sent: Thursday, March 27, 2008 11:49 AM
Subject: Requested corrections/revisions

Hi ,

Below is a list of the corrections / revisions that we discussed on the March 25 meeting, please review and see if I missed anything. I asked the Water Board to provide a similar list of their requests so that you can create a matrix for us to check off once the corrections/revisions have been made. Could you check this against your notes and if anything was missed, please add to the list, and get the list to GLA.

By the way, I didn't see any County LEA staff there, did you invite them?

If you have any questions please call me at 818-889-8628. If BFI can make the corrections / revisions, I think that you will have a slope stability analysis that will accurately be reflective of what is actually proposed by BFI.

Thanks

Eugene

Requested Corrections / Revisions to the Slope Stability Analysis

1. Include the figures/drawings to reflect the actual proposed final cover design on each of the cross sections used for the slope stability analysis. (The current cross section drawings of the cover (in the appendix) are not what is being proposed).
2. Revise/complete the settlement contour drawing to show the "calculated settlement in feet for "City-Side" landfill refuse place before 2010". (Drawing only revised to show the County side but not the City side). Please note, that this should also include the areas of the currently closed City landfills)
3. Correct the cross section drawing for D-D' to reflect that the proposed expansion actually is on top of an old existing landfill section
4. Correct the cross section drawing for E-E' to reflect that the proposed expansion actually is on top of an old existing landfill section
5. Redo the stability analysis for Section D-D' (or new critical planes) to account for the fact that the proposed expansion is on an existing closed City landfill, and that the base liner angle will be

steeper due to additional settlement of the existing landfill ("bowling" effect). Also prepare an analysis to show the "sensitivity" of safety factor of this potential increase slope angle for the base liner that is place over an existing landfill.

6. The toe of the landfill also intersects part of the closed City Landfill. Review if the potential settlement of the closed landfill may potentially impact the functionality of the toe berm.
7. Redo the stability analysis for Section E-E' (or new critical planes) to account for the fact that the proposed expansion is on an existing closed City landfill, and that the base liner angle will be steeper due to additional settlement of the existing landfill ("bowling" effect). Prepare an analysis to show the "sensitivity" of safety factor of this potential increase slope angle for the base liner that is place over an existing landfill.
8. Redo the identification of the critical planes with the proposed design (if needed)
9. Provide reference drawing that shows the small ridge area in the area of the toe berm of cross section D-D'.
10. Revise/recalculate the critical shear strength parameters for the proposed liner system using a reinforced GCL.
11. On Section D-D', the parameters/calculations indicate the use of cementitious materials being used for the toe berm. Since this is not what is ideal (e.g., cracking, etc.,) and not what is actually being proposed, revise the drawings (and cross sections) to reflect what is actually being proposed, e.g., soil, MSW, etc.) The slope stability analysis should be redone to reflect the changes.

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N4
RESPONSE TO LA-CITY LEA COMMENTS
SUNSHINE CANYON LANDFILL CITY-COUNTY JTD
APRIL 22, 2008



GeoLogic Associates

Geologists, Hydrogeologists and Engineers

MEMORANDUM

TO: PAUL WILLMAN, BAS

DATE: April 22, 2008

FROM: GARY LASS, GLA

GLA JOB #: 2007.0009

RE: RESPONSE TO LA-CITY LEA COMMENTS
SUNSHINE CANYON LANDFILL CITY-COUNTY JTD

This memorandum presents GeoLogic Associates' (GLA) responses to comments on the Joint Technical Document (JTD) for the proposed Sunshine Canyon City/County Landfill by Eugene Tseng of the City of Los Angeles LEA in an e-mail letter to Mr. Paul Willman fo Bryan A Stirrat & Associates, Inc. dated March 27, 2008. Each comment is addressed in order below.

Comment #1

"1. Include the figures/drawings to reflect the actual proposed final cover design on each of the cross sections used for the slope stability analysis. (The current cross section drawings of the cover (in the appendix) are not what is being proposed)."

Response

This comment is addressed in revised Figure 48 of BAS' response to agency comments on the Sunshine Canyon Landfill JTD, dated April 9, 2008.

Comment #2

"2. Revise/complete the settlement contour drawing to show the 'calculated settlement in feet for 'City-Side' landfill refuse place before 2010'. (Drawing only revised to show the County side but not the City side). Please note, that this should also include the areas of the currently closed City landfills)"

Response

The settlement analysis has been revised and is presented in the revised response to RWQCB comments (revised date 4-22-08).

Comment #3, 4, 5, 6, 7 and 8

- "3. Correct the cross section drawing for D-D' to reflect that the proposed expansion actually is on top of an old existing landfill section*
- 4. Correct the cross section drawing for E-E' to reflect that the proposed expansion actually is on top of an old existing landfill section*
- 5. Redo the stability analysis for Section D-D' (or new critical planes) to account for the fact that the proposed expansion is on an existing closed City landfill, and that the base liner angle will be steeper due to additional settlement of the existing landfill ("bowling" effect). Also prepare an analysis to show the "sensitivity" of safety factor of this potential increase slope angle for the base liner that is place over an existing landfill.*
- 6. The toe of the landfill also intersects part of the closed City Landfill. Review if the potential settlement of the closed landfill may potentially impact the functionality of the toe berm.*
- 7. Redo the stability analysis for Section E-E' (or new critical planes) to account for the fact that the proposed expansion is on an existing closed City landfill, and that the base liner angle will be steeper due to additional settlement of the existing landfill ("bowling" effect). Prepare an analysis to show the "sensitivity" of safety factor of this potential increase slope angle for the base liner that is place over an existing landfill.*
- 8. Redo the identification of the critical planes with the proposed design (if needed)"*

Response

The stability analyses have been revised and is presented in the revised response to RWQCB comments (revised date 4-22-08).

Comment #9

- "9. Provide reference drawing that shows the small ridge area in the area of the toe berm of cross section D-D'."*

Response

Attached as Figure 1 is the current surface topography of the site underlain by the 1952 USGS pre-landfill topography. The small ridge shown on the section is indicated. In addition to the topographic evidence, the attached aerial photograph underlying the topographic data indicates the presence of a bedrock exposure.

Comment #10

"10. Revise/recalculate the critical shear strength parameters for the proposed liner system using a reinforced GCL."

Response

The critical shear strength parameters for the proposed liner system have been revised in response to RWQCB comments (revised date 4-22-08).

Comment #11

"11. On Section D-D', the parameters/calculations indicate the use of cementitious materials being used for the toe berm. Since this is not what is ideal (e.g., cracking, etc.,) and not what is actually being proposed, revise the drawings (and cross sections) to reflect what is actually being proposed, e.g., soil, MSW, etc.) The slope stability analysis should be redone to reflect the changes."

Response

The stability analyses have been revised to incorporate earth materials and affect of this change is presented in the revised response to RWQCB comments (revised date 4-22-08).

